

CONTRIBUTION TO THE STUDY OF PLANT COMMUNITIES DOMINATED BY *AILANTHUS ALTISSIMA* (MILL.) SWINGLE, IN THE EASTERN ROMANIA (MOLDAVIA)

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ABSTRACT. In this paper, we aimed to analyze the structure, ecology and syntaxonomy of the communities dominated by *Ailanthus altissima*, in the Eastern Romania (Moldavia). This study has been achieved during our research on alien plants, conducted in 2009-2010. A number of 20 vegetation relevés have been carried out according to the Braun-Blanquet's methodology, in the spontaneous communities of *Ailanthus altissima*. The investigations led to the description of a new plant association (*Balloto nigrae-Ailanthetum altissimae* ass. nova). It is subordinated to the alliance *Balloto nigrae-Robinion* Jurko ex Hadač & Sofron 1980, order *Chelidonio-Robinietales* Jurko ex Hadač & Sofron 1980, class *Robinietales* Jurko ex Hadač & Sofron 1980. Recognition species are *Ballota nigra* and *Ailanthus altissima*. Besides these, among the characteristic species of higher syntaxa (alliance, order, class), the following species stand out: *Bromus sterilis* (constant), *Urtica*

dioica and *Galium aparine* (sub-constant). The stands are found on sunny lands, on roadsides, railway embankments, railway stations, steep slopes, ravines, abandoned fields, abandoned orchards or vineyards on terraces, ruderal lands, sandy lands, degraded pastures, or on the edge of *Robinia pseudacacia* plantations. They are situated between 38 and 265 m a.s.l. In ecological terms, the association *Balloto nigrae-Ailanthetum altissimae* includes heliophilous (sub-heliophilous), moderate thermophilous, xero-mesophilous, neutrophilous and moderate nitrophilous phytocoenoses. The results are discussed against the background of similar investigations of anthropogenic woody plant communities carried out by others authors.

Key words: *Ailanthus altissima*; Anthropogenic plant communities; Invasive alien plants; Phytosociological studies.

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REZUMAT – Contribuție la studiul comunităților vegetale dominate de *Ailanthus altissima* (Mill.) Swingle, în estul României (Moldova). În această lucrare, autorii si-au propus să analizeze structura, ecologia și sintaxonomia comunităților dominate de *Ailanthus altissima*, din partea de est a României (Moldova). Studiul acestor comunități a fost realizat pe parcursul cercetărilor de teren asupra plantelor adventive, efectuate în anii 2009-2010. Au fost realizate un număr de 20 relevee fitosociologice, în comunitățile spontane de *Ailanthus altissima*, după metoda elaborată de către Braun-Blanquet. Investigațiile efectuate au dus la descrierea unei noi asociații de plante (*Balloto nigrae-Ailanthetum altissimae* ass. nova). Aceasta se încadrează în alianța *Balloto nigrae-Robinion* Jurko ex Hadač & Sofron 1980, ordinul *Chelidonio-Robinietales* Jurko ex Hadač & Sofron 1980, clasa *Robinietales* Jurko ex Hadač & Sofron 1980. Speciile de recunoaștere pentru această asociație sunt: *Ballota nigra* și *Ailanthus altissima*. Pe lângă acestea, dintre speciile caracteristice pentru sintaxonii superiori (alianță, ordin, clasă), se remarcă următoarele: *Bromus sterilis* (specie constantă), *Urtica dioica* și *Galium aparine* (specii sub-constante). Fitocenozele asociației au fost întâlnite pe terenuri înșorite, la marginea drumurilor, pe terasamente de cale ferată, în gări, pe versanți abrupti, ravene, terenuri abandonate, livezi sau vii abandonate de pe terase, terenuri ruderales, terenuri nisipoase, pajiști degradate sau la marginea unor plantații de *Robinia pseudacacia*, între 38 și 265 m altitudine absolută. Din punct de vedere ecologic, asociația *Balloto nigrae-Ailanthetum altissimae* include fitocenoze heliofile (subheliofile), moderat termofile, xero-mezofile, neutrofile și moderat nitrofile. Rezultatele obținute au fost discutate în contextul investigațiilor similare asupra comunităților antropogene de plante lemnoase, efectuate de alți cercetători.

Cuvinte cheie: *Ailanthus altissima*; comunități antropogene de plante; plante adventive invazive; studii fitosociologice.

INTRODUCTION

The invasion of alien plants is widely recognized as one of the major threats to diversity and functions of natural and agricultural ecosystems, causing at the same time significant losses in economy and human health (Lonsdale, 1999; McNeely, 2001; Pimentel *et al.*, 2000; Vitousek *et al.*, 1997; Wittenberg and Cock, 2001). Among the invasive alien plant species in Europe, one of the most important is *Ailanthus altissima* (Anastasiu and Negrean, 2007; Arnaboldi *et al.*, 2002; Basnou and Vilà, 2009; Essl and Rabitsch, 2002; Kowarik and Säumel, 2007; Udvardy, 2008; Wittenberg, 2005). This is a tree native to China, and according to Hu (1979), it was introduced in Europe (France), at 1740. Since then, it spread almost throughout Europe, being cultivated mainly for ornamental purposes, but also in forest plantations, for erosion control, or for ecological restoration of some industrial habitats. (Dumitriu-Tătăranu, 1960; Hu, 1979; Kowarik and Säumel, 2007; Udvardy, 2008).

In the meantime, *Ailanthus altissima* became a widely naturalized species in Central and Southern Europe (Albania, Austria, Azores, Belgium, Britain, Bulgaria, Corsica, the former Czechoslovakia, France, Germany, Greece, Switzerland, Spain, Hungary, Italy, the former Yugoslavia, Portugal, Romania,

Russia, Sardinia, Sicily) (Tutin, in Tutin *et al.* (eds), 1968), and in North America (Britton and Brown 1970; Hu, 1979), where it was introduced around 1784 (Hu, 1979), but also in South-Western Asia, Southern Africa and Australia (Kowarik and Säumel, 2007). It is now regarded as one of the worst invasive alien species in Europe, excepting Northern regions (Basnou and Vilà, 2009; Essl and Rabitsch, 2002; Kowarik and Säumel, 2007; Udvardy, 2008; Vilà *et al.*, 2009; Wittenberg, 2005).

In Romania, this species was mentioned in the second half of the nineteenth century, as a cultivated plant (Brândză, 1879-1883; Fătu, 1871; Simonkai, 1886). Grecescu (1898) noted that *Ailanthus altissima* ("stinking tree") is "introduced and coarsen in Bucharest and surroundings". In the early twentieth century, *Ailanthus altissima* was cited as a sub-spontaneous tree in Moldavia, at Iași (Stamatin, 1906, cited by Răvăruf, 1941). Borza (1925) considered that *Ailanthus altissima* is a "common trees near roads and houses", in Dobrogea, and that "peasants are not pleased to cultivate it". In the mid-twentieth century, according to Borza (1947), *Ailanthus altissima* was a sub-spontaneous tree in Moldavia, Banat and Dobrogea.

Nowadays, according to various authors (see below) and our unpublished data, *Ailanthus altissima* is spread (spontaneously) throughout the country, on the plains and hilly regions, usually in disturbed habitats: Maramureș - sporadic (Karácsonyi,

1995), Crișana - sporadic (Gergely *et al.*, 1966; Udvardy, 2008), Transilvania - sporadic (Simonkai, 1886; Udvardy, 2008), Banat - relatively frequent (Anastasiu *et al.*, 2005 - pers. comm.; Doltu *et al.*, 1983; Matacă, 2003; Roman, 1974; Sârbu A. *et al.*, 2007), Oltenia - relatively frequent (Decă *et al.*, 2006; Păun, 1965; Popescu, 1968; Popescu *et al.*, 2005), Muntenia - frequent (Alexiu, 2005; Borza, 1966; Mihail, 2005; Morariu, 1943; Popescu A., 1966), Dobrogea (including the Danube Delta) - frequent (Borza, 1925; Borza, 1944; Ciocărlan, 1994; Dihoru and Doniță, 1970; Dihoru and Negrean, 1976; Făgăraș *et al.*, 2008; Prodan, 1931) and Moldavia - frequent (Borza, 1958; Coroi, 2001; Coroi A.M., 2001; Dobrescu *et al.*, 1958; Dobrescu and Vițalariu, 1984; Leocov and Țopa, 1986; Mititelu and Barabaș, 1975; Mititelu and Nechita, 1992; Mititelu *et al.*, 1968; 1989; Monah, 2001; Oprea, 1997; Nechita, 1992; 2003; Papp and Răvăruf, 1938; Popa and Chifu, 2006; Sârbu, 1977; Sirbu, 2007; Stamatin, 1906, cited by Răvăruf 1941; Ștefan, 1997).

Through its allelopathic properties, high capacity for vegetative and generative reproduction, rapid growth, pioneer character, superior competitive ability against other alien or native plants, *Ailanthus altissima* is able to form dense populations which dominates the invaded plant communities and inhibits growth of other plant species, often displacing native vegetation (Arnaboldi *et al.*, 2002; Basnou and Vilà, 2009; Botta-Dukat, 2008; Dihoru and Doniță, 1970; Gutte *et al.*, 1987;

Landenberger *et al.*, 2006; Kowarik and Säumel, 2007; Vilà *et al.*, 2009; Wittenberg, 2005). In addition, the *ailanthone*, a quassinoid compound from the bark, is toxic to grazing stock and a skin irritant (Kowarik and Säumel, 2007; Wittenberg, 2005), and the pollen of *Ailanthus altissima* can induce allergic reactions to sensitive individuals (Ballero *et al.*, 2003, in Kowarik and Säumel, 2007). For these reasons, *Ailanthus altissima* was included in the list of the most invasive alien species in Europe, which cause significant harm to biological diversity and socio-economic values in this continent (Basnou and Vilà, 2009; Vilà *et al.*, 2009).

In this paper we aimed to analyze the structure, ecology and syntaxonomy of the communities edified by *Ailanthus altissima*, in the Eastern Romania (Moldavia).

MATERIALS AND METHODS

Phytocoenoses of *Ailanthus altissima* were investigated in the historical province of Moldavia (Eastern Romania), during our recent field works on alien plants (years 2009-2010). The present study is based on 20 vegetation relevés. Phytosociological surveys were conducted according to the classical methodology of the Zürich-Montpellier school (Braun-Blanquet, 1964).

Only spontaneous stands with *Ailanthus altissima* were taken into consideration. The relevé areas were between 50 and 200 m². In each relevé, the following data were recorded: species composition; total coverage (%) and height (m) of vegetation; species

abundance-dominance (AD), and in some cases (for *Ailanthus altissima*) number of individuals / m². After processing recorded relevés through the tabular method (Braun-Blanquet, 1964; Ivan, 1979) a new association was described. The association name is consistent with the *International Code of Phytosociological Nomenclature* (Weber *et al.*, 2000). The proportions of life forms, and phytogeographical elements (according to Ciocârlan, 2009) were calculated, based on species presence. The proportion and average of indices for light (L), temperature (T), soil moisture (M), soil reaction (R), and nitrogen (N), was also calculated. All these ecological indices were used according to Ellenberg *et al.* (1992). The results are discussed against the background of similar investigations of anthropogenic tree communities carried out by others authors. The nomenclature of the higher syntaxa follows Hadač and Sofron (1980), for *Robinietea* class, and Mucina *et al.* (1993), for the other syntaxa. Plant nomenclature follows Tutin *et al.* (1964-1980) and Tutin *et al.* (1993).

RESULTS

Following our investigations of plant communities edified by *Ailanthus altissima*, in different habitat types on the territory of Moldavia, we described a new association, framed in the syntaxonomical system as follows:

Class **ROBINIETEA** Jurko ex Hadač & Sofron 1980

Order **CHELIDONIO-ROBINIETALIA** Jurko ex Hadač & Sofron 1980

BALLOTO NIGRAE-AILANTHETUM ALTISSIMAE ASS. NOVA

Alliance **BALLOTO NIGRAE-ROBINION** Jurko ex Hadač & Sofron 1980

Association ***Balloto nigrae-Ailanthetum altissimae*** ass. nova.

Holotype: Table 1, relevé no. 3.

Phytosociological structure.

Plant composition and structural characteristics of the association *Balloto nigrae-Ailanthetum altissimae* (Fig. 1-3) are shown in Table 1. Within the analyzed relevés, a total number of 142 plant species were recorded, but most of them have a low

constancy. Only 12 species are constant or sub-constant. The number of species per relevé is between 12 and 34, with a mean ($\pm$ SD) of 23.4 ± 5.8 .

Besides the recognition species of the association, *Ailanthus altissima* (dominant) and *Ballota nigra* (characteristic), among the recognition species of higher syntaxa (alliance, order, and class), the following species stand out: *Bromus sterilis* (constant), *Urtica dioica* and *Galium aparine* (sub-constant).



Figure 1- Phytocoenosis of *Ailanthus altissima* near Mălușteni village (Vaslui county)

Into the plant composition, there are many recognition species for classes *Artemisietea vulgaris* (25%) and *Stellarietea mediae* (18%), as an expression of the disturbed nature of habitats in which such communities are installed, and as witnesses of the

successional stages that led to their establishment. But many of these species, being more or less heliophilous, they usually grow at the periphery of phytocoenoses, and therefore they do not contribute in a large measure in the structure of

phytocoenoses (except *Elymus repens*, *Artemisia vulgaris*, *Leonurus cardiaca*, *Arctium lappa*, and *Bromus sterilis*). Due to the eutrophic nature of the biotope, the recognition species of the class *Galio-Urticetea* also have an important weight in plant composition (11%). Some of them, being less heliophilous (*Geum urbanum*, *Glechoma hederacea*,

Rubus caesius etc.), can penetrate inside the phytocoenoses, contributing to the herbaceous layer. Other species come from the flora of the surrounding xero-mesophilous (*Festuco-Brometea*) or mesophilous (*Molinio-Arrhenatheretea*) grasslands or from the zonal shrubs (*Rhamno-Prunetea*) and forests (*Querco-Fagetea*).



Figure 2 - Phytocoenosis of *Ailanthus altissima* near Pogana village (Vaslui county)

Synmorphology and synphenology. The phytocoenoses are dense, with a general coverage up to 100%. They are dominated by *Ailanthus altissima*. The stands are three-layered. The tree layer, with a height of 4-8 m, and 75-100% coverage, is dominated almost exclusively by *Ailanthus altissima*. The middle layer, with a coverage between 5-60%, consists mainly of numerous clonal offspring of

Ailanthus altissima (10-37/m²), and in a smaller proportion, some shrubs, such as: *Rosa canina*, *Rubus caesius*, *Lycium barbarum*, *Prunus spinosa* etc. The herbaceous layer shows a different coverage (up to 25%), depending on the season: on the spring, before leaf emergence of the dominant species, *Bromus sterilis* grows abundantly (vernal aspect). During the summer, when the foliage of the dominant species determines a

BALLOTO NIGRAE-AILANTHETUM ALTISSIME ASS. NOVA

dense shadow, among the dry stalks of vernal species, some less heliophilous species can grow, such as: *Ballota nigra* (constant, characteristic), *Elymus repens* (constant), *Galium aparine*, *Geum urbanum*, *Glechoma hederacea*,

Urtica dioica etc. (the summer aspect). Into the younger phytocoenoses, most individuals of *Ailanthus altissima* have the same height, so stratification is less obvious.



Figure 3 - Phytocoenosis of *Ailanthus altissima* in the surrounding of Huși town (Vaslui county)

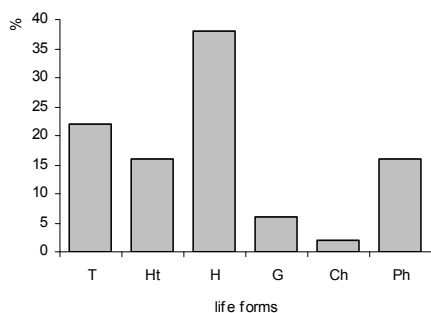


Figure 4 - Life forms spectrum
(*T*-therophytes; *Ht*-hemitherophytes; *H*-hemicryptophytes; *G*-geophytes; *Ch*-chamaephytes; *Ph*-phanerophytes)

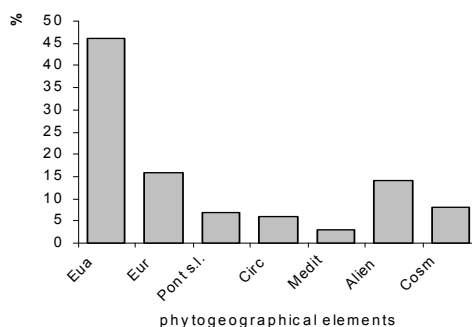


Figure 5 - Phytogeographical spectrum
(*Eua*-Eurasian; *Eur*-European; *Pont*-Pontic; *Circ*-Circumpolar; *Medit*-Mediterranean; *Cosm*-Cosmopolitan)

The hemicryptophytes (38%), therophytes (22%), hemitherophytes (16%) and phanerophytes (16%) prevail in the structure of biological forms (Fig. 4). Eurasian (46%), European (16%) and alien (14%) species dominate the phytogeographical spectrum of the association (Fig. 5). Other floristic elements are less represented.

Synecology. The stands are found on sunny lands, on roadsides, railway embankments, railway stations, steep slopes, ravines, abandoned yards, abandoned orchards or vineyards on terraces, vacant lands, sandy lands, degraded pastures, or on the edge of *Robinia pseudacacia*

plantations. They are situated between 38 and 265 m a.s.l. (average altitude $\pm$ SD is 133.9 ± 61.0 m a.s.l.). The average values of ecological indices for this association are as follows: $L_{7.4}T_{6.2}M_{4.3}R_{7.3}N_{5.8}$. So, the association *Balloto nigrae-Ailanthetum altissimae* includes heliophilous (sub-heliophilous), moderate thermophilous, xero-mesophilous, neutrophilous and moderate nitrophilous phytocoenoses. However, a large number of species in floristic structure of the association has a wide ecological tolerance to soil reaction and temperature (45% and 20%, respectively) (Fig. 6).

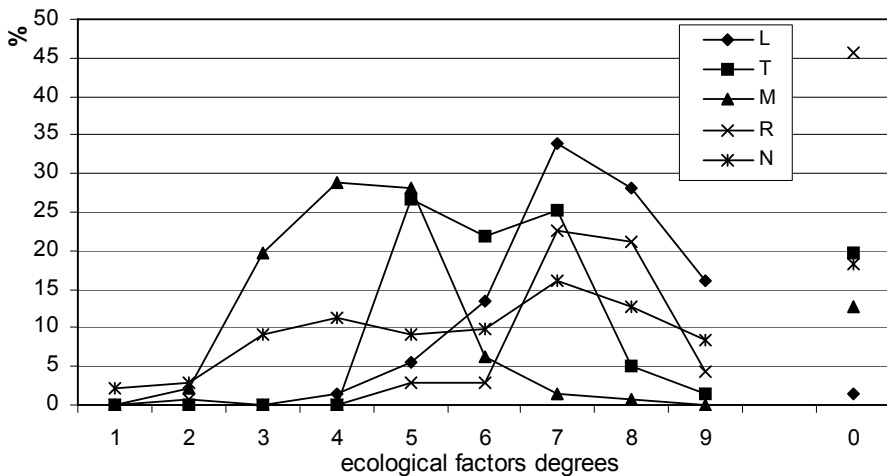


Figure 6 - Ecological spectrum (L-light; T-temperature; M-soil moisture; R-soil reaction; N- soil nitrogen content)

Syndynamic aspects. The analysis of the plant composition shows that this communities are usually installed in disturbed habitats, originally occupied by different

groups of ruderal weeds (*Stellarietea mediae*, *Artemisietea vulgaris*), or by some degraded pastures (*Festuco-Brometea*), in various successional stages. The presence of some sporadic

individuals of native shrubs (*Rosa canina*, *Prunus spinosa*, *Crataegus monogyna* etc.) or trees (*Ulmus minor*, *Acer campestre*), which do not grow in prosperous circumstances, could be an evidence of previous succesional processes developed before the invasion of *Ailanthus altissima*. However, shading caused by the mass development of *Ailanthus altissima* individuals, and perhaps their allelopathic effects, prevent the gradual replacement of this anthropogenic plant community by zonal vegetation. Thus, these phytocenoses, once consolidated, can have a long-term stability.

Synchronology. Phytocenoses of this plant association have been studied in various localities from Galați, Vaslui and Iași counties (the localities are shown beneath the Table 1).

DISCUSSION

The invasion of *Ailanthus altissima* in various native habitats (segetal and ruderal weed communities, degraded xero-mesophilous and mesophilous grasslands, scrubs, thermophilous forests etc.) is well documented, both in Europe (see Arnaboldi *et al.*, 2002; Botta-Dukat, 2008; Gutte *et al.*, 1987; Kowarik & Säumel, 2007) and North America (Call and Nilsen, 2003; Heisey, 1997; Knapp and Canham, 2000; Pan and Bassuk, 1986).

Ailanthus altissima has also been identified in Romania, as a casual or

invasive species, in phytocenoses belonging to different plant associations. In this sense, for the Eastern Romania, the next associations can be listed (Chifu *et al.*, 2006): *Cirsietum lanceolati-arvensi* Mititelu 1972 (alliance *Onopordion acanthii* Br.-Bl. *et al.* 1936), *Arctietum lappae* Felföldy 1942, *Polygoneto dumetori-Bryonietum albae* Ștefan 1997 (alliance *Arction lappae* R. Tx. 1937), *Taraxaco serotinae-Festucetum valesiacae* (Burduja *et al.* 1956, Răvăruf *et al.* 1956) Sârbu, Coldea *et al.* 1999 (alliance *Festucion valesiacae* Klika 1931), *Bromo sterilis-Robinetum* (Poés 1954) Soó 1964 (alliance *Balloto nigrae-Robinion* Jurko *ex* Hadač and Sofron 1980), *Cynodonto-Atriplicetum tataricae* Morariu 1943, *Kochietum densiflorae* Gutte *et al.* Klotz 1985 (alliance *Atriplicion nitentis* Passarge 1978), *Erigeronto-Lactucetum serriolae* Lohmeyer in Oberd. 1957 *em.* Mucina 1978, *Hordeetum murini* Libbert 1933 (alliance *Sisymbrium officinalis* R. Tx., Lohmeyer *et al.* Preising in R. Tx. 1950).

Both in Europe (Dihoru & Doniță, 1970; Dobrescu and Vițalariu, 1984; Gutte *et al.*, 1987; Kowarik and Säumel, 2007; Mucina *et al.*, 1993; Schubert, 2001) and North America (Heisey, 1997; Pan and Bassuk, 1986), *Ailanthus altissima* often forms nearly pure stands in $\pm$ disturbed habitats, that are resistant to invasion by other tree species.

Table 1 - Ass. *Balloto nigrae-Ailanthetum altissimae* ass. nova

L. f.	Phyt. el.	Relevé number																			
		1	2	3*	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Altitude (m)	98	63	172	93	43	139	140	124	124	140	150	145	88	38	260	265	196	180	90
		Surface (m ²)	50	100	100	150	50	50	100	50	60	64	100	100	100	50	200	100	100	60	100
		Aspect	-	-	S	E	W	E	W	SE	SE	E	W	SE	-	W	S	S	S	N	SW
		Slope (degrees)	0	0	10	10	0	40	0	10	20	5	10	0	20	40	15	10	45	35	30
		Number of species	16	26	26	19	26	30	12	20	28	30	25	26	20	20	16	25	21	17	30
		Tree layer	100	100	90	90	85	95	95	100	100	100	100	90	100	100	90	100	100	75	90
		Shrub and juvenile layer	5	10	20	25	5	10	15	10	40	15	5	60	5	10	20	5	20	30	20
		Coverage (%)	5	5	10	10	15	5	<5	5	10	15	20	<5	<5	5	15	25	10	15	15
		Herbaceous layer	5	5	10	10	15	5	<5	5	10	15	20	<5	<5	5	15	25	10	15	15
MPh	Alien: E As	Ailanthus altissima	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	4	5
		Ailanthus altissima (juv.)	1	1	2	2	1	1	2	1	3	2	1	4	1	1	2	1	2	3	2
Balloto nigrae - Robinion																					
H	C Eur	Ballota nigra	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
T	Eua (sMedit)	Bromus sterilis	1	+	1	1	1	-	-	+	1	+	-	1	+	+	-	2	1	1	1
Chelidonio - Robinietalia & Robinietea																					
H	Cosm	Urtica dioica subs. dioica	+	-	+	+	-	+	+	-	-	-	+	-	-	-	+	-	+	+	+
T	Circ	Galium aparine	-	+	+	+	-	-	+	+	-	+	-	-	+	-	-	+	-	1	+
MPh	Alien: N Am	Robinia pseudacacia	1	-	+	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
MPh	Alien: W As, E Eur	Prunus cerasus (juv.)	-	-	-	-	+	-	-	-	1	+	+	-	-	-	-	-	-	-	-
H	Eua	Chelidonium majus	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	+
MPh	Alien: N Am	Gleditsia triacanthos	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
MPh	Alien: N Am	Acer negundo	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
T	Pont-Medit	Anthriscus cerefolium subsp. trichosperma	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-
MPh	Alien: SE Eur, As	Prunus cerasifera	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	+
Gallo-Urticetea																					
H	Eua (sMedit)	Sambucus ebulus	+	-	-	-	-	+	+	+	+	+	+	+	-	-	+	-	+	1	III
H	Circ	Geum urbanum	+	-	+	-	-	-	-	-	+	+	+	-	-	-	-	+	-	-	-
H	Eua	Glechoma hederacea	-	-	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+

L. f.	Phyt. el.	Relevé number																			
		1	2	3*	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		98	63	172	93	43	139	140	124	124	140	150	145	88	38	260	265	196	180	90	130
		50	100	100	150	50	50	100	50	60	64	100	100	100	50	200	100	60	100	60	100
		-	-	S	E	W	E	W	E	W	SE	SE	-	W	W	S	S	S	S	N	SW
		0	0	10	10	0	40	0	10	20	5	10	0	20	40	15	10	45	35	30	25
		16	26	26	19	26	30	12	20	28	30	25	26	20	20	16	25	21	17	30	34
		100	100	90	90	85	95	95	100	100	100	100	90	100	100	90	100	100	75	90	100
		5	10	20	25	5	10	15	10	40	15	5	60	5	10	20	5	20	30	20	10
		5	5	10	10	15	5	<5	5	10	10	15	20	<5	<5	<5	5	15	25	10	15
		Herbaceous layer																			
Ht	Eua	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	0.1
H	Eua	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	0.1
H	c Eua	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	0.1
Ht	Eua	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	0.1
Ht	Eua	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	0.1
Stellarietea mediae																					
T	Cosm	+	+	+	-	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-	0.2
Ht	Eua	-	+	-	-	+	+	+	-	+	-	-	-	+	+	+	+	-	-	-	0.2
T	Circ	+	-	-	+	+	+	+	-	+	-	-	-	-	-	-	-	+	-	-	0.2
T	Allen: N Am	+	-	-	+	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	0.1
T	Allen: N Am	-	+	+	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	0.1
T	Cosm	-	-	-	-	-	+	-	+	-	-	-	-	-	+	+	+	-	-	-	0.1
T	Allen: N Am	-	+	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	-	-	0.1
T	Allen: N Am	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
T	Eua	-	+	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	0.1
T	Cosm	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	0.1
T	Eua	-	1	-	-	1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	0.5
T	Allen: As	-	+	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	0.1
T	C Eur	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	+	-	0.1
T	C Eua	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
T	Allen: c Eua	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	0.1
Festuco-Brometea																					
H	Eua	-	-	-	-	-	+	-	-	+	-	+	+	-	-	-	-	-	-	-	0.1

Relevé number		1	2	3*	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Altitude (m)		98	63	172	93	43	139	140	124	124	140	150	145	88	38	260	265	196	180	90	130
Surface (m ²)		50	100	100	150	50	50	100	50	100	60	64	100	100	100	50	200	100	100	60	100
Aspect		-	-	S	E	E	W	E	W	E	SE	SE	-	W	W	S	S	S	S	N	SW
Slope (degrees)		0	0	10	10	0	40	0	10	20	5	10	0	20	40	15	10	45	35	30	25
Number of species		16	26	26	19	26	30	12	20	28	30	25	26	20	20	16	25	21	17	30	34
Tree layer		100	100	90	90	85	95	95	100	100	100	100	100	90	100	100	90	100	100	75	90
Shrub and juvenile layer		5	10	20	25	5	10	15	10	40	15	5	60	5	10	20	5	20	30	20	10
Coverage (%)		5	5	10	10	15	5	<5	5	10	10	15	20	<5	<5	5	15	25	10	15	
Herbaceous layer		5	5	10	10	15	5	<5	5	10	10	15	20	<5	<5	5	15	25	10	15	
L. f. Phyt. el.																					
Medium K coverage (%)																					
Molinio-Arrhenatheretea																					
H	Pont-Balc		-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
H	c Eua		-	+	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Ch	c Eua		-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H	Pont-Medit		-	+	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-
T	Pont-Medit		-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molinio-Arrhenatheretea																					
H	Medit		-	-	-	+	-	-	-	-	+	-	+	-	-	-	-	+	-	+	-
H	Eua		-	-	-	-	-	-	-	-	+	+	+	-	-	-	+	-	-	-	-
H	Eua		+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-
H	Circ		-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	1	-	-
H	Eua		-	-	-	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-
H	Cosm		-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-
H	Cosm		-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-
Querco-Fagetea																					
MPh	Eur		-	-	-	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-
nPh	Eur		-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-
Rhamno-Prunetea																					
nPh	Eur		+	-	+	-	-	+	-	-	-	-	-	+	+	-	+	+	+	-	-
nPh	Allen: E As		-	-	-	-	-	-	-	-	+	+	1	-	-	-	-	+	-	+	-
nPh	Eur		-	-	+	-	-	-	-	-	-	+	-	1	-	-	-	-	-	+	-
nPh	C Eur		-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	+	-

scabra (16⁺), *Senecio erucifolius* (13⁺); **Molinio-Arrhenatheretea**: *Crepis biennis* (12⁺), *Lotus corniculatus* (2⁺), *Odontites vernus* subsp. *serrotinus* (16⁺), *Taraxacum officinale* (20⁺); **Quercio-Fagetea**: *Acer campestre* (juv.) (10⁺), *Brachypodium sylvaticum* (18⁺), *Fraxinus excelsior* (12⁺); **Rhamno-Prunetea**: *Cornus sanguinea* (11⁺), *Physalis alkekengi* (12⁺), *Rhamnus cathartica* (12⁺); **Variae syntaxa**: *Fraxinus pennsylvanica* (1⁺), *Plantago lanceolata* (5⁺).

Place and date of relevés: **1** - Munteni de Jos (Vaslui county), roadside, 28.08.09; **2** - Bârlad (Vaslui county), railway station, 28.08.09; **3*** - Pogana (Vaslui county), ravine, 28.09.09; **4** - Ezăreni (Iasi county), roadside, near sunflower, 11.09.09; **5** - Iasi (IS), at the crossroads Săulescu and Cloșca (abandoned yard), 01.08.09; **6** - Crăiești (Galați county), steep slope, near the road, 02.08.09; **7** - Negrești (Vaslui county), vacant land near Bârlad river, 13.08.09; **8, 9** - Huși (Vaslui county), slopes near the railway embankment, 22.08.09; **10** - Iasi (Iasi county), Adamachi farm, abandoned orchards, on terrace platform, 20.09.09; **11** - Iasi (Iasi county), Adamachi farm, abandoned orchards, on terrace slope, 20.09.09; **12** - Iasi (Iasi county), Adamachi farm, abandoned vineyard, 15.07.09; **13** - Stoișești (Vaslui county), steep slope, 07.08.10; **14** - Murgeni (Vaslui county), railway embankment, 08.08.10; **15** - Mălușteni (Vaslui county), steep slope, near the road, 09.08.10; **16** - Mălușteni (Vaslui county), grassland, on sandy ground, 09.08.10; **17** - Huși to Crasna (Vaslui county), strongly inclined slope, 09.08.10; **18** - Șerbești (Vaslui county), slope with degraded grassland near *Robinia pseudacacia* plantation, 26.08.10; **19** - between Epureni and Floreni (Vaslui county), railway embankment, 27.08.10; **20** - Crăiești (Galați county), degraded grassland, 26.07.2010.

Legend: **L. f.** - Raunkyaer's life forms (according to Ciocărlan, 2009); **Phyt. el.** - phytogeographical elements (according to Ciocărlan, 2009); * holotype of the association (relevé no. 3); **K** - constancy classes (see Braun-Blanquet, 1964; Ivan, 1979).

Dihoru, in his PhD thesis (1969), thereafter Dihoru and Doniță (1970), in *Flora and Vegetation of Babadag Plateau*, have proposed a new plant community, namely "*Ailanthetum altissimae* prov.", with a brief description and a picture, but without a phytosociological table, or even a list of species. Following these authors, on Babadag Plateau (Dobrogea), "... such groups of *Ailanthus* are common in crops, gardens, pastures (sometimes in steep, loessoid places)...", but "...they also appear in Bucharest on disturbed or excavated places, near the pits etc., normally preferring Southern exhibitions...". This syntaxon was also mentioned in the literature (as "*Ailanthetum altissimae* Dihoru (1969) 1970" or "*Ailanthetum altissimae* Dihoru 1970") from Moldavia, at Bivolari, Iași county (one relevé) (Dobrescu and Vițalariu, 1984), from Muntenia, at Malul Moștiței - Mănăstirea and at Valea Argovei (without relevés) (Sanda *et al.*, 1980), from Măcin Mountains (without relevés) (Doniță *et al.*, 2007), but also in Central Europe (Germany) (Schubert, 2001).

According to Dobrescu and Vițalariu (1984), phytocoenoses of "*Ailanthetum altissimae* Dihoru (1969) 1970" can be met in several places from Moldavia. However, they published only one single relevé, which they considered as representative one, with a surface of 150 m², and which were recorded on an eastern slope, with a declivity of 30°, in a ruderal place, on waste

deposits. In addition, according to Doniță *et al.* (2007), in the Măcin Mountains (Valea Sulucului, near Regie), phytocoenoses of the association "*Ailanthetum altissimae* Dihoru (1969) 1970" conquer areas of 300-400 m², in some xerophilous grasslands of *Festucetum callierii* Șerbănescu 1965 apud Dihoru (1969) 1970, and *Cynodonti* – *Poëtum angustifoliae* (Rapaics 1927) Soó 1957, preferring those lands with excess of nitrogenous substances, especially those with ash deposits which resulted either from household activities, either from intentional burning of spontaneous vegetation.

However, according to the *International Code of Phytosociological Nomenclature* (Weber *et al.* 2000), "*Ailanthetum altissimae* prov.", published by Dihoru and Doniță (1970), is not a valid name, because it is suggested by the authors as a provisional name (Art. 3b), and in addition, the authors did not publish neither a vegetation relevé, nor a synoptic table or even a list of species, for the proposed association, so it is not accompanied by a sufficient original diagnosis (Art. 2b, Art. 7).

Dihoru and Doniță (1970) classified those communities of *Ailanthus altissima* into the alliance *Arction lappae* R.Tx. 1937, order *Onopordetalia acanthii* Br.-Bl. et R. Tx. ex Klika et Hadač 1944, class *Artemisietea vulgaris* Lohmeyer *et al.* ex von Rochow 1951. This classification has subsequent been used by all other Romanian botanists

(Dobrescu and Vițăliu, 1984; Doniță et al., 2007; Sanda et al., 1980), but in Germany, Schubert (2001) includes "*Ailanthetum altissimae* Dihoru 1970" into the alliance *Arctio-Sambucion nigrae* Doing 1962, order *Sambucetalia nigrae* Oberd. 1957, class *Urtico-Sambucetea* (Doing 1962) Pass. 1968 (nitrophilous, elder scrubs of derelict habitats in the Atlantic zone).

Other authors do not consider at all that neophytic tree communities can form true associations, because of their allochthonous status within the boundaries of a study area, their lability, and the absence of characteristic species (Tüxen and Ellemberg, 1947, cited by Hadač and Sofron, 1980). Mucina et al. (1993) includes the communities of *Ailanthus altissima* (as *Ailanthus altissima*-(*Lamio albi-Chenopodietalia*)-Gesellschaft), in „Andere Gessellschaften der Ordnung *Lamio albi-Chenopodietalia*-Gruppe von Gehölz-Gessellschaften". Similarly, Pott (1995) includes *Ailanthus altissima*-Gesellschaften, in "Gebüsche und Vorwälder, anthropogene Gehölzgesellschaften". However, the possibility of the classification of vegetation stands with non-native tree species as true associations, parts of the system of natural plant communities, has been well argued by many authors, starting with Jurko 1963 (see Exner and Willner, 2004; Hadač and Sofron, 1980; Zerbe, 2003). According to Hadač and Sofron (1980), the anthropogenic tree communities are

not necessarily more labile and poorer in characteristic species than many natural associations. In addition, many plant communities of ruderal or segetal weeds, dominated by alien plants, are recognized in the literature as true associations, and there is no substantial reasons that anthropogenic tree communities should not be similarly treated (Hadač and Sofron, 1980).

Classification of anthropogenic tree communities in higher syntaxa varies greatly into the phytosociological literature. We agree with Hadač and Sofron (1980), Chytrý and Tichý (2003), and Exner and Willner (2004), which state that these must be placed into a distinct class, namely: *Robinietae* Jurko ex Hadač & Sofron 1980. This class includes anthropogenic tree communities, colonizing disturbed habitats, such as deforested lands, selvedges, agricultural and industrial fallows etc., and according to Chytrý and Tichý (2003), it has the following characteristic species: *Robinia pseudacacia* (diagnostic, constant, dominant), *Chelidonium majus* (diagnostic, constant); *Poa nemoralis*, *Impatiens parviflora*, *Sambucus nigra* (constant, dominant), *Galeopsis pubescens*, *Galium aparine*, *Geranium robertianum*, *Geum urbanum*, *Rubus fruticosus* agg., *Urtica dioica* (constant).

According to Hadač and Sofron (1980), and Chytrý and Tichý (2003), the class *Robinietae* includes a single order, *Chelidonio-Robinietaea* Jurko ex Hadač & Sofron 1980, with the

same characters as the class, subordinating two alliances, namely:

- *Chelidonio-Robinion* Hadač & Sofron 1980 (communities on loamy, mesic, eutrophic soils, or on solidified screes, usually on Southern, Eastern or Western slopes; characteristic combination: *Robinia pseudacacia*, *Prunus spinosa*, *Sambucus nigra*, *Chelidonium majus*, *Galium aparine*, *Impatiens parviflora*, *Poa nemoralis*, *Solidago gigantea* subsp. *serotina*, *Urtica dioica*);

- *Balloto nigrae-Robinion* Hadač & Sofron 1980 (communities on relatively poor sandy, dry soils, mainly in lowlands; characteristic combination: *Robinia pseudacacia*, *Sambucus nigra*, *Ballota nigra*, *Bromus sterilis*, *Galium aparine*, *Lactuca serriola*, *Poa angustifolia*, *Torilis japonica*). Some of these species, such as *Robinia pseudacacia*, *Sambucus nigra*, and *Galium aparine*, being common to the two alliances, they should be considered characteristic for the higher syntaxa (order, class).

Other classifications of anthropogenic tree communities, such as in the classes *Artemisietea vulgaris* Lohmeyer et al. ex von Rochow 1951 (Dihoru and Doniță, 1970; Dobrescu and Vițalariu, 1984), *Galio-Urticetea* Pass. et Kopecky 1969 (Mucina et al., 1993), *Urtico-Sambucetea* (Doing 1962) Pass. 1968 (Schubert, 2001) or in *Crataego monogynae-Prunetea spinosae* Tüxen 1962 (Boef et al., 2007; Ferner, 2009), violate the criterion of physiognomic homogeneity of higher syntaxa and

are not consistent with current syntaxonomical approaches in other vegetation units (Exner and Willner, 2004).

As it has been stated, *Ailanthus altissima* is listed among the most invasive alien species in Europe, causing significant harm to biological diversity and socio-economic values (Basnou and Vilà, 2009; Vilà et al., 2009). Therefore, the active involvement of professional organizations and authorized institutions is required, in order to limit its spread in Romania, to prohibit its further cultivation, and to prevent or minimise adverse impacts of this invasive alien species in agricultural or natural ecosystems. In other words, it must respect the principles set out in various international conventions to which Romania is part: *Convention on the Conservation of European Wildlife and Natural Habitats* - Bern, 1979; *European Strategy on Invasive Alien Species* - Bern, 2002 etc. (see also: Heywood and Brunel, 2008).

CONCLUSIONS

A new association was described in this paper, namely *Balloto nigrae-Ailanthetum altissimae* ass. nov., which was subordinated to the alliance *Balloto nigrae-Robinion* Jurko ex Hadač & Sofron 1980, order *Chelidonio-Robinietalia* Jurko ex Hadač & Sofron 1980, and class *Robinietea* Jurko ex Hadač & Sofron 1980.

The association includes heliophilous (sub-heliophilous), moderate thermophilous, xero-mesophilous, neutrophilous and moderate nitrophilous phytocoenoses, that invade anthropogenic and even natural habitats from Eastern Romania and which, once consolidated, can have a long-term stability.

Aggressive nature of the species *Ailanthus altissima*, requires an active involvement of professional organizations and authorized institutions to limit its spread in Romania and to prohibit its further cultivation.

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