FLORA AND VEGETATION OF ROMANIAN BANAT: AN OVERVIEW

G.-G., ARSENE, Ilinca Merima IMBREA, Alma Lioara NICOLIN, Alina-Georgeta NEACȘU

Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timișoara
Calea Aradului, 119, 300645, Timișoara
botanix.timagro@yahoo.com

Abstract. *The paper emphasizes as main feature of the province of Romania Banat (S-W Romania) its high diversity in vascular plant species and in plant associations. Vascular flora is composed from over 2.000 species, bellonging to diverse floristic elements (sub-Mediterranean, Pannonian, continental, Dacian, etc.). The vegetal carpet is also diverse and, in function of altitude, goes from sylvo-steppe to alpine grasslands, with many intra-zonal and azonal phytocoenosis. Protected areas (sites of community importance, especially) are numerous and covers a significant proportion of natural and semi-natural vegetation of the province. Although there are monographic studies of the flora and vegetation of geographic subunits of Banat, there are still many aspects of flora and vegetation to be elucidated and updated.*

Romanian Banat is a historical province outstanding, among others, for its flora and vegetation. This high vegetal diversity is the result of post-ice age evolution of the vegetal cover and of the interaction between abiotic factors (among which its geographical position that determines major climate influences, and its diverse geological substratum) and the anthropic factor that has been increasingly significant in the last two decades.

Natural and demi-natural vegetation covering mainly the hill, mountain, and sub-alpine-alpine areas make Banat a crossroads of routes of floristic migration and climate influences (among which the sub-Mediterranean one is to be noted). Thus, in the flora of the province there are Pannonian, sub-Mediterranean, continental, circumpolar, Atlantic, and Balkan floristic elements on a Eurasian background common to Romania's flora overall. The main migration routes are, from the south, thermophilous (sub-Mediterranean elements *largo sensu* – *Dasypyrum villosum*, *Euphorbia myrsinites*, *Saponaria bellidifolia*, *Trifolium resupinatum*, etc., and Balkan and Illyric – *Corylus colurna*, *Fagus x taurica*, *Sesleria rigida*, *Tragopogon balcanicus*, etc.), from the west (Pannonian and Atlantic elements – *Cirsium brachycephalum*, *Dianthus collinus*, *Pholiurus pannonicus*, *Rorippa kerneri*, and *Cardamine bulbifera*, *Colchicum autumnale*, *Elatine hexandra*, *Festuca arundinacea*, etc.), and from the east (continental, Dacian elements – *Dianthus giganteus*, *Melampyrum bihariense*, *Peucedanum rochelianum*, *Seseli gracile*, etc.). During the post-ice age era, Banat was a refuge for some tree species (beech, common oak) that migrated towards north (Apuseni Mountains) and north-east (Meridional Carpathians): this could explain the natural presence of beech and fir at the lowest altitudes in Romania and their persistence at low altitude that used to be colder. Recent palinologic research (FĂRCAS *et al*., 2005) shows that Banat was only a refuge for oak and elm.

In Banat, there are almost all the zones of vegetation in Romania, except for the steppe (though there are, in the Banat sylvo-steppe, plant associations specific to the steppe of Bărăgan and Dobrogea). On this background of levels, from the high plain to the peaks of the Țarcu Mountains, there are diverse situations where the about 2,000 cormophyta species (about half of the Romanian flora species) coexist in many coenotic combinations.

The sylvo-steppe cover the plain areas and its climaxic vegetation is made up of

northern red oak (*Quercus robur*) and ash (*Fraxinus excelsior*, *F. angustifolia*), forests that are a little more hydrophilous than those of the Moldavian or Transylvanian steppe. These plain and flooding meadow mixed foliage forests are also made up of field maple (*Acer campestre*), Tatar maple (*A. tataricum*), cornelian cherry (*Cornus mas*), common dogwood (*C. sanguinea*), elm (*Ulmus glabra*, *U. laevis*), common ivy (*Hedera helix* – an Atlantic element), common hop (*Humulus lupulus*), wild vine (*Vitis vinifera* subsp. *sylvestris*); the grassy level is made up of different sciaphilous vernal (*Anemone nemorosa*, *Corydalis cava*, *Ficaria verna*, *Scilla bifolia*, etc.) and aestival plants (*Alliaria officinalis*, *Brachypodium sylvaticum*, *Geum urbanum*, *Poa nemoralis*, *Pulmonaria officinalis*, etc.). According to the Natura 2000 classification, these forests (except for particular situations) belong to the habitat 91F0 – *Mixed flooding meadow forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia along the big rivers (Ulmenion minoris).* Along the rivers, white willow (*Salix alba*) and poplar (*Populus sp.*) make up gallery-forests with sometimes luxurious, species-poor vegetation (habitat 92A0 – *Gallery-forests of Salix alba and Populus alba*).

In most cases, sylvo-steppe grasslands have become agricultural lands and they persist, in xeric variants, a small spots on the slopes of valleys; in their floristic structure, there are also *Adonis vernalis*, *Bromus inermis*, *Carex humilis*, *Festuca valesiaca*, *Medicago falcata*, *Phlomis tuberosa* and other species. The association of secondary grasslands typical to the sylvo-steppe is made up of *Agrostis capillaris* and *Festuca rupicola*. Some of the species on such grasslands have become ruderal plants (*Bromus inermis*, *Falcaria vulgaris*, *Salvia nemorosa*, *Artemisia sp.*) because of the restriction of their habitat. The richest from a floristic point of view and the most productive from an agronomic point of view sylvo-steppe grasslands are haymaking flooding meadows made up by meadow foxtail (*Alopecurus pratensis*), cock's foot (*Dactylis glomerata*), false oat grass (*Arrhenatherum elatius*), together with numerous legumes (*Lotus corniculatus*, *Medigaco lupulina*, *Trifolium repens*, *Vicia sp.*) and a rich line of species from other botanical families.

Fig.1 Salt marshes at Diniaș: in the first plan, a draining canal with eroded slope. (photo G.-G. ARSENE,

September 2014).

The intra-area vegetation of salt marshes of primary and secondary origin (appeared after land improvement works) has a Pannonian feature – two Hungarian steppe associations: *Artemisio-Festucetum pseudovinae* Soó in Máthé 1933 corr. Borhidi 1996 and *Achilleo-Festucetum pseudovinae* Magyar (1928) Soó 1933. The genus *Trifolium* is well represented in the halophilous flora of Banat, and the other associations of salt marshes are largely common to the Hungarian steppe and to the areas of continental salt marshes of Romania: *Camphorosmetum annuae* (Rapaics 1916) Soó 1933, *Beckmannietum eruciformis* Rapaics ex Soó 1930, *Hordeetum hystricis* (Soó 1933) Wendelberger 1943, *Pholiuro-Plantaginetum tenuiflorae* (Rapaics 1927) Wendelberger 1943, *Puccinellietum limosae* Rapaics ex Soó 1933, etc. In a few locations with moist salt marshes there is also *Cirsium brachycephalum*, a specie of the Annexes II and IV of the Habitat Directive (92/43/EEC), and *Trifolium ornithopodioides* is included in the Red List of vascular plant from Romania as well as *Lotus angustissimus*, another salt marsh species (DIHORU & NEGREAN, 2009). The flora and vegetation of salt marshes have been studied since the beginning of the 1970s within applicative research often wrongfully oriented. Nowadays, in European countries, salt marshes are no longer seen as lands that need to be improved for agronomic purposes. Almost all salt marshes in the Pannonian bio-region (to which belong low altitude areas in west and north-west Banat) should be protected as Natura 2000 priority habitat (1530* – *Pannonian steppes and salty marshes*).

Aquatic and paludous vegetation that used to cover larger areas in the past does not differ from that of the neighbouring areas and can be found in the meadows of the rivers and near lakes; many of these moist areas are protected, since 2007, by Natura 2000. Water and paludous phytocenoses belong to the classes *Lemnetea* O. de Bolós et Masclans 1955, *Potamogetonetea* R. Tüxen et Preising 1942, *Isoëto-Nanojuncetea* Br.-Bl. et R. Tüxen ex. Westhoff *et al*. 1946 and *Phragmitetea australis* R. Tüxen et Preising 1942. *Marsilea quadrifolia*, a species indicative of the natural dynamics of the rivers, included in the Annexes II and IV of the Habitat Directive (92/43/EEC) can be found in a few marshes in the Timiș River meadow. *Lindernia procumbens* (Krock.) Philcox., another species in the Annexes II and IV of the Habitat Directive, can also be found in a few locations of moist Banat areas (NEACSU, 2008).

Fig.2 Satchinez Marsh – one of the few natural moist areas in the Banat plain. (photo A.-G. NEACSU, 2014)

The nemoral area covers the Piedmont and plateaus and it is covered by forests of Turkey oak (*Quercus cerris*) and Hungarian oak (*Quercus frainetto*) (the association *Quercetum frainetto-cerris* (Georgescu 1945) Rudski 1949), included in the habitat type Natura 2000 *Balkan-Pannonian Turkey oak and sessile oak forests* (91M0). In the tree layers, together with making up plants, there are also European hornbeam, field maple, silver lime and, towards the upper high altitude limit (about 600 m), sessile oak. With differences in altitude and soil, they have in their grassy layer, *Buglossoides purpurocaerulea*, *Campanula persicifolia*, *Genista tinctoria*, *Helleborus odorus*, *Lathyrus niger*, *Silene coronaria*, *Melittis melissophyllum*, *Poa nemoralis*, *Potentilla alba*, *Pulmonaria mollis*, *Tanacetum corymbosum*, *Veratrum nigrum*, etc. Turkey oak-sessile oak forests or sessile oak-Turkey oak forests on the lime substratum in south Banat resemble quite much those of Trans-Danubia (limes and dolomites in the Bakony Mountains, Mecsek Hills, Hungary – BÖLÖNI, 2004) and Serbia – HORVÁT, 1968) are very diverse from the point of view of the grassy cover (depending on local conditions) and of the structure of the tree layer (made up of different species); treatments applied to these forests simplified the structure of tree and bush layers: therefore, this type of forests in protected areas need to change the type of management.

Fig.3 Turkey oak (*Quercus cerris* – left) and sessile oak (*Q. frainetto* – right) associate frequently in the nemoral area of Banat (photo G.-G. ARSENE).

The hill area of Banat, as well as the hill areas of same altitude from Romania, is the area of sessile oak (*Quercus petraea*); pure sessile oak forests are rather rare, while co-dominance of sessile oak and beech and European hornbeam are frequent. Numerous tree and grass species are common to sessile oak and Turkey oak-sessile oak forests. On carbonatic substrata, Banat sessile oak-European hornbeam forests (with Turkey oak and oak mixtures) have an Illyric aspect due to the presence of the species *Helleborus odorus*, *Asperula taurina*, *Ruscus aculeatus*, *R. hypoglossum*, *Tamus communis* (GAFTA & MOUNTFORD, 2008). In the hill area and in the lower mountain area, on sunny lime rocks (Cerna Mountains, Anina Mountains, Locva Mountains, Gorgan Mountains), there are also thermophilous bushes, a vegetation formation occurring in Romania only in Dobruja and Oltenia and characteristic to the areas south of Danube: they are made up of Eurasian smoke tree (*Cotinus coggygria*), manna ash (*Fraxinus ornus*), Oriental hornbeam (*Carpinus orientalis*), lilac (*Syringa vulgaris*). Banat thermophilous bushes belong to the Order *Syringo-Carpinion orientalis* Jakucs 1960. Most of them also belong to the priority habitat 40A0* – *Peri-Pannonian sub-continental bushes*. On the cliffs of the Danube Pass, Nera Gorges and Cerna Mountains, there is also, sporadically, yew (*Taxus baccata*) – a Tertiary relic as well as Banat Austrian pine (*Pinus nigra*) growing on the lime rocks of the Cerna Valley and in some other locations of south Banat, that make up communities with such species as *Genista radiata*, *Fraxinus ornus*, *Cotinus coggygria*, *Biscutella laevigata*, *Ceterach officinarum*, *Festuca xanthina*, *Seseli rigidum*, *Campanula kladniana*, *Centaurea rhenana* and *Campanula divergens*.

The grasslands at the level of sessile oak are made up of *Agrostis capillaris*, *Festuca rupicola*, *Festuca pratensis*, *Cynosurus cristatus*, etc. Fertilising these grasslands increases the share of mesophilous species (*Lolium perenne*, *Festuca pratensis*, *Poa pratensis*, *Trifolium repens*) of high fodder value. Irrational exploitation of these grasslands (over-grazing in easy-accessible areas near localities) and abandonment of exploitation (favouring the settling of *Pteridium aquilinum* and of woody vegetation) are equally damaging floristic diversity and landscape. In a national context, grasslands of *Chrysopogon gryllus* on skeleton soil, in the

Anina-Carașova area, part of *Agrostio-Chrysopogonetum* Kojič 1957 (*Danthonio-Chrysopogonetum* BOSCAIU 1972), that contain species common to the grasslands of Serbia and Bulgaria (*Achillea crithmifolia*, *Anthericum liliago*, *Dianthus giganteus*, *Dorycnium herbaceum*, *Galium tenuissimum*, *Hipochoeris maculata*, *Muscari comosum*, *Rhinanthus rumelicus*) are typical for the Banat area. Likewise, the floristic structure of other grasslands in the nemoral area and in the hill area of Banat included in *Festucetalia valesiacae* Br.-Bl. & R.Tx. ex Br.-Bl. 1949 and *Brometalia erecti* (W. Koch 1926) Br.-Bl. 1936 resembles similar grasslands (located at higher altitudes) in the Balkans (REDZIC, 1991).

The Danube Valley and the Anina Mountains, most of which is included in protected areas, in natural parks, in national parks, and Natura 2000 sites have many specific flora and vegetation features due to thermophilous species (*Ruscus aculeatus*, *Corylus colurna*, *Helleborus odorus*, *Staphylea pinnata*, *Allium flavum*, etc.). In the Danube Pass, near Dubova, there grows *Tulipa hungarica*, and near Baziaș, *Paeonia officinalis* subsp. *banatica*; on the Ciclova Valley, below the Simion Peak, there is still a small population of *Paeonia mascula*.

Fig.4 Banat Austrian pine (*Pinus nigra*) at Herculane. (photo S. ZĂRESCU, 2004).

In the Porțile de Fier Natural Park, in the Cheile Nerei-Beușnița, Domogled-Valea Cernei natural parks and in other Banat areas, there is a remarkable richness of declining orchid species (RÖSLER & GOGA, 2002; ARDELEAN, 1997, BÂTEA, 2012) (particularly the species of the Genus *Ophrys*) because of habitat deterioration (MILANOVICI, 2012). Forests along rivers are made up of common alder (*Alnus glutinosa*), often mixed with white willow (*Salix alba*); given their functional importance, though they do not harbour species relevant for conservation, riparian forests are a priority importance habitat (91E0* – *Alluvial forests of Alnus glutinosa and Fraxinus excelsior*).

Banat's beech forests, displayed along an altitudinal range between 200 m (Mraconia Valley) and 1450 m (on top of the Semenic Mountain) have diverse coenotic combinations, from the virgin forest at Izvoarele Nerei, with a poor grassy layer, to Illyric (*Aremonio-Fagion*) or Dacian (*Symphyto-Fagion*) combinations. There are also frequent level inversions towards the limit of the beech forests (with the level of Norway spruce below the level of beech, the level of mixtures of beech + resinous trees above the level of Norway spruce), because of both natural and anthropic cause (forest exploitation). The typical secondary grassland of this level is that made up of red fescue (*Festuca rubra*) and common bent (*Agrostis capillaris*), in

numerous variants and extremely rich floristically – over 250 species of Cormophyta (COSTE & ARSENE, 2000) (*Achillea millefolium*, *Anthoxanthum odoratum*, *Briza media*, *Carlina acaulis*, *Cynosurus cristatus*, *Dianthus carthusianorum*, *Gymnadenia conopsea*, *Campanula patula*, *Hypochaeris radicata*, *Leucanthemum vulgare*, *Plantago lanceolata*, *Rhinanthus minor*, etc.). Such polyfloral grasslands that have not been subjected to intensive agronomic practices yet, are a valuable natural heritage and an excellent starting point in the development of organic agriculture and of tourism.

Compact, monodominant associations appear in these areas because of acidification without reaching the floristic richness of compact, monodominant associations in the Apuseni Mountains, though an estimate of the floristic richness of a compact, monodominant associations in Banat reach about 150 species of Cormophyta (COSTE & ARSENE, 2000). In the floristic composition of compact, monodominant associations on the Mic Mountain, GRIGORE *et al*. (1970) identify, among high frequency species (besides *Nardus stricta* and *Festuca rubra*), *Antennaria dioica*, *Deschampsia flexuosa*, *Geum montanum*, *Luzula campestris*, *Potentilla erecta*, *Potentilla aurea* subsp. *chrysocraspeda*, *Viola dacica*). Compact, monodominant associations in the Semenic Mountain are rather poor in species represented mainly by *Nardus stricta* and *Deschampsia cespitosa*, together with *Festuca rubra*, *Campanula abietina*, *Danthonia decumbens*, *Luzula luzuloides*, *Potentilla erecta* and a few other species.

Peat bogs do not cover large areas in Banat; the most well known are in the Semenic Mountains, poorer in Cormophyta species than the bumpy peat bogs in the Apuseni Mountains or the Oriental Carpathians. Among Cormophyta species in these peat bogs, we need to mention (CIOBANU, 1948): *Carex canescens*, *C. echinata*, *C. limosa*, *C. nigra*, *C. rostrata*, *C. tetrastachya*, *Epilobium palustre*, *Eriophorum latifolium*, *E. vaginatum*, *Juncus filiformis*. The biologist of the Semenic National Park – Caraș Gorges has recently found *Drosera rotundifolia* (SINCULET, com. pers.). Moss belongs mainly to the Genus *Sphagnum* (*S. nemoreum*, *S. recurvum*, *S. subsecundum*, etc.). Pollinic analysis of the peat in the Semenic Mountain by RÖSCH & FISCHER (2000) show that the historical evolution of the vegetation was neatly different from that of the mountains in Central Europe and that the expansion of the beech starting with the Bronze Age is related to the anthropic factor. Sporo-pollinic diagrammes and Cormophyta flora of peat bogs in the Țarcu Mountains, Godeanu Mountains and Cernei Mountains are mentioned by the monumental monograph of the flora and vegetation of these mountains by Nicolae BOSCAIU (BOSCAIU, 1971).

Rocks, particularly lime ones, are the only locations of remarkable species that contribute substantially to the floral and phyto-sociological diversity of Banat. Some associations of rocks and detritus can be found in Romania in Banat alone (possibly in the neighbouring mountain ranges – COLDEA *et al*., 1997): *Seslerietum filifoliae* Zolyomi 1939 (Orșova, Miniș Gorges, Cazane), *Seslerio haynaldianae-Saxifragetum rochelianum* Boșcaiu 1971 (Țarcu Mountains, Godeanu Mountains, Cerna Mountains, and also Retezat Mountain), as well as associations of the *Micromerion pulegii* alliance Boșcaiu (1971) on the rocks in the Almăj Mountains and Cerna Mountains, with diagnosis species such as *Athamanta hungarica* Borbás, *Dianthus petraeus* Waldst. & Kit., *Erysimum comatum* Pančić, *Clinopodium pulegium* (Rochel) Bräuchler (=*Micromeria pulegium* (Rochel) Benth.), *Silene saxifraga* L.

The level of Norway spruce, the sub-alpine level (of mountain pine) and the alpine level (of alpine grasslands) are represented in the Țarcu-Godeanu Mountains. Norway spruce forests have a rare, dispersed bushy stratum (*Rubus idaeus*, *Lonicera xylosteum*, *Spiraea*

ulmifolia), as the grassy one (*Oxalis acetosella*, *Homogyne alpina*, *Senecio fuchsii*, etc.), but the moss stratum is abundant. Monodominant bushes of mountain pine (*Pinus mugo*) alternate with bushes of blueberry (*Vaccinium uliginosum* = *V. gaultherioides*, *V. myrtillus*, *V. vitis-idaea*), groups of *Rhododendron myrtifolium* Schott & Kotschy, bushes of *Juniperus communis* var. *saxatilis* (*J. nana*) and *Bruckenthalia spiculifolia* and compact, monodominant associations. In the level of alpine grasslands, of permanent snows and of alpine belts in the Țarcu Mountains, there are alpine species common to other mountains over 2,000 m high (*Agrostis rupestris*, *Campanula alpina*, *Carex curvula*, *Juncus trifidus*, *Lioseleuria procumbens*, *Soldanella montana*, *S. pusilla*). Compact, monodominant associations at high altitudes in the Țarcu Mountains cover large areas (BOSCAIU, 1971; GRIGORIU, 2004), and their presence is the result of successive processes triggered by the deforestation of juniper bushes and of alpine and subalpine bushes (*Junipero-Bruckentalion*), followed by a phase of grasslands of *Festuca rubra* subsp. *commutata* (= *F. nigrescens*) with *Agrostis rupestris*.

The segetal flora of Banat was the subject of studies carried out by researchers from the Agronomic Institute in Timișoara (G. BUJOREAN, S. GRIGORE, I. COSTE, A. POP, etc.). Research results were published in the proceedings of national symposia on weed science and in other journals or remained unpublished as research contract reports. Straw cereal crops in Banat are invaded by such weeds as *Anagalis arvensis*, *Cirsium arvense*, *Convolvulus arvensis*, *Fallopia convolvulus*, *Stellaria media*, *Viola arvensis*. Chemical control measures reduced the presence of straw cereal weeds (*Apera spica-venti*, *Centaurea cyanus*, *Gallium aparine*, *Consolida regalis*). On plots cultivated with maize in the plain area, such weeds as *Chenopodium album*, *Convolvulus arvensis*, *Echinochloa crus-galli*, *Galinsoga parviflora*, *Hibiscus trionum*, *Polygonum persicaria* are rather frequent. With rather wide variations in the last 30 years (because of cultivation technologies), the Banat segetal flora is a rich one compared to that of

Fig.5 Agrostemma githago (common corn cockle) – a segetal species with growing populations in Banat after a period (1970-1980) of chemical control (photo G.-G. ARSENE).

agricultural areas in Western Europe where they have controlled chemically for decades now. The high diversity of weeds has been maintained by the abandonment of arable lands; uncultivated lands in Banat are very diverse floristically and phyto-sociologically and have, besides the negative effect of practicing agriculture (increase of the weed seed supply in the soil, infestation of close soles) also positive effects (recovery of soil fertility parameters, habitat for pollinators and game, source of forage for domestic cattle, etc.). Studies regarding

the conservation of segetal species in Banat (in other European countries, numerous weed species are on Red Lists) are still young.

The number of Cormophyta species in Banat included in Red Lists (OLTEAN *et al.*, 1994, BOSCAIU *et al.*, 1994, COSTE & ARSENE, 2000) is relatively large; the most recent Red List (DIHORU & NEGREAN, 2009) also includes numerous species from Banat: *Acanthus hungaricus* (Borbás) Baen. (= *A. balcanicus* Heywood & F.B.K.Richardson), *Clinopodium graveolens* subsp. *rotundifolium* (Pers.) Govaerts (= *Acinos rotundifolius* Pers.), *Aethionema saxatile* (L.) R.Br., *Alyssum tortuosum* Willd., *Alyssum wierzbickii* Heuff., *Arabis collina* Ten., *Asperula laevigata* L., *Asplenium adulterinum* Milde, *A. haussknechtii* Godet & Reut. (= *A. lepidum* C. Presl), *A. onopteris* L., *Astragalus depressus* L., *Botrychium matricariifolium* (Döll) A. Braun ex W.D.J. Koch, *Campanula crassipes* Heuff., *Cardamine enneaphyllos* (L.) Crantz, *C. parviflora* L., *Carduus kerneri* subsp. *lobulatiformis* Soó (= *C. lobulatiformis* Csürös & Nyár.), *Cirsium creticum* (Lam.) d'Urv., *Convolvulus althaeoides* L. subsp. *tenuissimus* (Sibth. & Sm.) Stace, *Hippocrepis emerus* subsp. *emeroides* (Boiss. & Spruner) Lassen (= *Coronilla emerus* subsp. *emeroides* (Boiss. & Spruner) Holmboe), *Corydalis intermedia* (L.) Mérat, *C. pumila* (Host) Rchb., *Daphne laureola* L., *Dryopteris submontana* Fraser-Jenk., *Ecbalium elaterium* (L.) A.Rich., *Elatine hexandra* (Lapierre) DC., *E. hungarica* Moesz, *E. triandra* Schkuhr, *Elymus panormitanus* (Parl.) Tzvelev, *Euphorbia myrsinites* L., *Ferula heuffelii* Griseb. ex Heuff., *Galium lucidum* All., *Genista januensis* Viv., *G. radiata* (L.) Scop., *Glyceria declinata* Bréb., etc.

The scientific study of Banat's flora started in the 19th century, when travellers and naturalists from Western Europe visited the province and herborised eventually publishing notes on the plant species and the vegetal cover: Carl Gabriel BAENITZ, Johann Nepomuk BAYER, Arpad von Felsöhagy DEGEN, Wilhelm SEYMANN, Johannes WAGNER, Piotr Pawlus WIERZBICKI, Lajos RICHTER, Imré FRIVALDSZKY etc. The first flora of Banat (and the single one until now) was made up by the doctor and pharmacist Johann HEUFFEL in 1858: *Enumeratio plantarum in Banatu Temesiensi sponte crescentium et frequentius cultarum*. We need to remind, though not a complete work of flora (i.e. it is not exhaustive), the work *Plantae Banatus rariores iconibus et descripcionibus illustratae. Praemisso tractatu phyto-geographico et subnexis additamentis in terminologiam botanicam* by Anton ROCHEL, published in Pesta, in 1828.

Botany research developed after the Great Union of 1918, particularly after the displacement of the University of Cluj to Timişoara during World War II, after the Dictate of Vienna. The years 1970-1980 brought about remarkable botanical monograph works regarding some geomorphologic units in Banat (N. BOSCAIU – the Ţarcu Mountains, Godeanu Mountains and Cerna Mountains, 1971; S. GRIGORE – the Timiş-Bega Interfluve, 1971; L. SCHRÖTT – the Cheile Nerei-Beuşniţa Reserve, 1972; I. COSTE – the Locva Mountains, 1974; E.C. VICOL – the Lugoj Piedmont, 1974; C. LAUER – the grasslands of the Crasova carst, 1974; P. PEIA - the Almăj Depression, 1978; I. HOBORKA – the Dognecea Mountains, 1980, etc.).

Among works on Banat botany (flora and vegetation of Cormophyta) published after 1990, we need to mention those referring to the monograph study of some taxons (*Dianthus giganteus* subsp. *banaticus* – JARDA, 2011), grassland vegetation in the upper and middle basin of the Timiş River (NICOLIN, 2004), salt marshes (PĂTRUT, 2004), medicinal plants (MOCIOI, 2002; ANTAL, 2005), moist areas (NEACSU, 2008), orchidaceae of the spontaneous flora (BÎTEA *et al*. 2014; MILANOVICI, 2012), segetal flora (FĂRCĂSESCU, 2008), as well as mainly flora studies representing research results carried out recently by NEGREAN (2012) and

KARACSONYI (2012).

Current flora and vegetation studies are triggered by the need to inventory as exactly as possible the vegetal diversity and to take protection measures given the increasing pressure on natural resources and the economic context. The study of the ecology of native invasive species (*Ailanthus altissima*, *Ambrosia artemisiifolia*, *Amorpha fruticosa*, *Echinocystis lobata*, *Eriochloa villosa*, *Helianthus tuberosus*, *Reynoutria japonica*, *Robinia pseudoacacia*, etc.) aiming at limiting their expansion, the response of species and phytocenoses to climate change are other current research topics. Research of flora and vegetation of Banat enters a new era, that of great database, of the identification of species and vegetal associations through processing of satellite images, of detailed studies of sites and plots, of new instruments (field kits for identification and for genetic and biochemical analyses, etc.); it will undoubtedly surprise those who will commit to the study of the vegetal carpet of Banat.

Fig.6 Tree of Heaven (*Ailanthus altissima*) – an invasive tree expanding in south Banat (photo G.-G. ARSENE)

Fig.7 False indigo (*Amorpha fruticosa*) – one of the most aggressive invasive plants in the river meadows of western Romania (photo. G.-G. ARSENE)

Selective Reading

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