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Research Paper

Rare and Endemic Plant Species in Conacu - Negreşti Valley, Dobrogea, Romania

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Abstract: Conacu-Negrești Valley is located in the center of Cobadin Plateau, subunit of Negru Vodă Plateau, South Dobrogea, Romania. It landscape consists predominantly of Cretaceous and Sarmatian limestone, placed on a Precambrian background and covered by a thick blanket of 40 m of Quaternary loess. The valley is characterized by an extremely rich and diverse geo-biodiversity with many rare and endemic species of wildlife Dobrogea and Romania, too. The paper presents the floral diversity identified so far in this valley, focusing on the description of 12 species of rare and endemic plants identified in the area, species of great scientific and practical importance. The data represent the results of the research activities developed within the framework of our scientific and educational program on geo-bio-diversity and its protection of the Conacu- Negrești Valley from 2002 until now.

Keywords: Plants diversity, Rare and endemic species, Conservation status, Natural and human threats, Conacu-Negreşti Valley, Dobrogea - Romania

Abbreviations:Zoogeoelements: continental (C), Daco-Moesian-Dobrogean (DMD), Pontic-Tauric-Balkan (PTB), Scythian (S), East Balkan (EB), Mediterranean (M), Scythian-Thracian-Anatolian (STA), Balcanic (B), Dobrogean-Balkan (DB), european endemite (EE). Conservation status: vulnerable species (VU), threatened species (EN), low-risk species (LR), critically endangered species (CR).

INTRODUCTION

Dobrogea is located on the northern Balkan Peninsula in southeastern Central Europe ($44^0$17`03,77``N, $28^0$21`53,27``E), after to http://ro.wikipedia.org/wiki (Figure 1 A, B). It occupies an area of approximately 23.142 km^2, of which 15.570 km^2 are located in Romania (making up 6.52% of the total area

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of Romania) and 7.572 km^2 in Bulgaria. The Dobrogea Region is bordered by the lower Danube River to the southwest, west, northwest and north, the Danube Delta to the northeast, the Black Sea to the east and the Ludogorie Plateau to the southeast and south (Peahă, 1982). The most easterly point of Dobrogea lies at $29^0$41`24`` east longitude, corresponding area of the Sulina, Romania.

North Dobrogea is located in the south-eastern of Romania and is composed of two subunits, each with distinctive physical-geographical, soil and climate features: continental Dobrogea (Dobrogea Plateau) and maritime Dobrogea (Skolka *et al.*, 2005).

The Dobrogea Plateau is divided into three geographical units: Northern Dobrogea with a average altitude of 200 m, Central Dobrogea, and Southern Dobrogea, the latter two units with average altitudes of 100 m.

North Dobrogea encompassed several distinct geographic subunits: the Măcin Mountains, the Niculițel Plateau, the Tulcea Hills and the Babadag Plateau. The Măcin Mountains are the oldest mountain range in Europe, formed during the late Paleozoic Hercynian orogeny, with a maximum altitude of 476 m on Țuțuiatu Peak (also named Greci Peak).

Central Dobrogea contains the Casimcea Plateau, the oldest topographic relief in Dobrogea, formed during the early Paleozoic Caledonian orogeny (Al-Azki, 2003, 2006).

South Dobrogea includes the Oltina and Negru-Vodă Plateaus.

The maritime portion of Dobrogea contains the Danube Delta (a fluvial-marine plain undergoing continuous genesis), the Razelm-Sinoie Lagoon complex, and the supra-littoral zone of the Black Sea (Al-Azki, 2007, 2010-2011a, b).

By Axini (2006) and Iana (1970), the location 0f Conacu-Negreşti Valley in south-eastern Romania (in Negru-Vodă Plateau - the parallel $43^0$58`48,93`` north latitude and the meridian $28^0$10`05,12`` east longitude) explains, the continental climate characteristics of the region, which influences all environmental characteristics (Figure 1 C) (Brezeanu, 1997; Coteț, 1969).

MATERIAL AND METHODS

Until 2003, the valley was known only from the geographical field studies and research of Mrs. Dr. Sofia Iana, University from Bucharest, Romania, on the Negru-Vodă Plateau. In 2003, the "Monachus" Group of Scientific Research and Environmental Education, Constanța, Romania developed a study and research project on the geo-bio-diversity of the Conacu-Negresti Valley. Our effort became a comprehensive long-term research program, undertaking new research and public education projects for environmental protection of this valley.

In terms of phyto-diversity and its conservation research, have established different observation, identification and sampling stations both the water basin and the valley.

10 stations were established at different points in the lake, taken differently depending on the nature of the substrate, lake depth, the existence of marsh, aquatic vegetation. From these stations were taken monthly samples. All samples were taken from the coastal area of the lake.

On the land, were established 12 stations depending on the type of existing habitat in the valley: limestone walls with rocks to date, grassy hills, canyons, plateaus, ravines, debris walls, limestone walls with fossil mollusks.

For plant species identification, it was widely used field observations and photographs made monthly by the team, along with field trips. Some species of plants required the collection and subsequent

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determination based on herbarium prepared. Subsequently, all samples have been transported, stored and examined / studied in our laboratories.

The identification of some plant species also required the collection of anatomical organs. Subsequently, they underwent microscopic laboratory investigations for morpho-anatomic and genetic determinations.

The nomenclature of taxa and data processing is according to data from literature as well as national and international legislation.

RESULTS AND DISCUSSIONS

In South Dobrogea, the Conacu-Negreşti Valley is located on a north-west to south-east axis. It is a *"canara"* (Iana, 1973), a term specific to Dobrogea, and meaning a valley generally short, narrow, with limestone slopes, high and steep walls with small caves, partly covered with SubMediterranean xerophyte meadows and scrub forest vegetation.

Conacu-Negreşti Valley, part of South Dobrogea, is distinguished by spectacular landscape beauty and is characterized by rich and diverse assemblage. Its significance also is derived from its geological, geomorphological and paleontological characteristics (Axini, 2011).

According to Axini and Al-Azki (2017), the valley previously was dominated by one dense forest of pubescent oak (*Quercus pubescens*), the remnants of which can be seen on the lake bottom. The proof that the valley was dominated by an oak forest is the angle of inclination of both limestone walls of the valley and the presence of herbaceous and shrub plant and invertebrates species, which normally live together in a oak forest (Axini, 2012a, b; Axini and Al-Azki, 2012; Axini and Al-Azki, 2016a, b; Axini *et al*., 2010; Skolka, 2008).

Thus far, we have detected a total of 301 plant species, among 32 orders and 62 families (Andrei, 2003; Axini, 2009; Axini and Al-Azki, 2017a; Axini and Tofan, 2009; Ciocâlan, 2000; Cristurean and Lițescu, 2002a, b; Morariu and Todor, 1972; Prodan, 1936a, b; Prodan and Buia, 1966; Săvulescu (ed), 1952-1976; Todor, 1968).

By Axini (2009), in numerical order, the families represented the largest number of species are: *Compositae* - 42 taxa, *Graminaceae* - 30 taxa, *Labiatae* - 25 taxa, *Caryophyllaceae* - 14 taxa; *Rosaceae, Leguminosae* and *Cruciferae* families, each of them with 13 taxa (Figure 2).

The dominant shrub species in the valley include species as *Prunus spinosa* L. and *P.* (*Padus*) *mahaleb* (L.) Borkh. (Fam. Rosaceae Juss.), *Crataegus monogyna* Jacq. (Fam. Rosaceae Juss.), *Cornus mas* L. (Fam. Cornaceae Link.) - species found in the two canyons from the south-west of the valley, on the plateaus, and on the walls with southeast and northeast aspect in the central valley.

On the limestone walls, plateaus, grassy hills and in the canyons of the southwest part of the valley, invasive plant species also occur and including species like *Ailanthus altissima* (Mill.) Swingle (Fam. Simaroubaceae L. C. Rich.), *Elaeagnus angustifolia* L. (Fam. Elaeagnaceae R. Br.), *Gleditshia triacanthos* L. (Fam. Cesalpiniaceae), *Hedera helix* L. (Fam. Araliaceae Vent.), *Robinia pseudacacia* L. (Fam. Leguminosae Juss.), and *Morus* sp. (Fam. Moraceae Lindl.).

A total of 12 rare and endemic plant species have been detected in the valley (Table 1) (Axini, 2012c, d; Axini and Al-Azki, 2017b; Dihoru and Dihoru, 1994; Dihoru and Negrean, 2009; Făgăraș *et al*., 2010; Nanova *et al*., 2008; Olteanu *et al*., 1994).

Adonis volgensis Steven ex DC. (syn. *Adonis vernalis* L. subsp. *volgensis* (Steven

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ex DC.) Korsh; *Anemone cicutaria* Gandoger; *Adonanthe volgensis* (Steven ex DC.) Chrtek & Slavíková) (Figure 3 A) is a perennial plant, up to 45 cm high. Its leaves have toothed lobes; and reproduces sexually, with direct or/and indirect pollination by insects. Its fruits and seeds are dispersed by ants. This species blooms in April-May (Anastasiu *et al*., 2008; Szabó, 1973).

It is a heliophyte and xerophyitici species, widespread in the plains and hills, on dry, sunny soils that are neutral in pH and low in mineral nitrogen soils, in steppe grasslands.

In Romania, it was occurs in Transylvania, Moldavia and Dobrogea. In Dobrogea, it was previously known only from the northern region, between Jurilofca and Gagebischi Liman, where it was identified by G. Grințescu, Romanian botanist, under the name *Adonis villosa-vernalis* (copy found in Herbarium of Romanian Institut of Biology of Romanian Academy in Bucharest, BUCA), and it was found Tulcea (identified by the same botanist as the *A. walziana*). In the southern region, it occurs near resorts close to the Conacu-Negrești Valley (Basarabi, Fântânița-Murfatlar Reserve and Cobadin) (Dihoru *et al*., 1965; Grecescu, 1898; Zahariadi, 1964).

In Conacu-Negrești Valley, *A. volgensis* was detected only on a limestone plateau ($43^0$59`19,11`` N, $28^0$19`42,60``E), approximately in the center of the valley. On the plateau edges, in the east, southwest, southeast, east, agro-ecosystems may threaten this species. There, it co-occurss with *Asperula tenella* Heuff. ex Degen (Rubiaceae), *Adonis flammea* Jacq. (Ranunculaceae), etc. (Tutin *et al*., 1964-1980, 1996).

The scientific and practical importance of *A. volgensis* are high because it is the medicinal and toxic plant.

Unfortunately, *A. volgensis* is threatened by reduction and degradation of its habitats by grubbing and overgrazing, expansion of agricultural area and excessive collections. These impacts haves, lead to population reduction. To these impacts can be added natural factors related to the biology of the species, with low seeds production, failure of vegetative propagation, and occasional attack by microscopic fungi.

Parietaria lusitanica L. subsp. *serbica* (Pančić) P.W. Ball (syn. *P. serbica* Pančić, *P. chersonensis* Grec. (Figure 3 B) is an annual plant, 5-30 cm tall, that reproduces sexually and has indirect anemophilous pollination and fruit and seeds dissemination in its habitats. It blooms from May – September. *P. serbica* lives on rocks and stones, and is shade-loving, often occurring in cracks in rocks. It is a calciphile, that grows in hilly and sub-mountainous areas. It does not typically co-occur with other species in the low quality, rocky soils.

In Romania, *P. serbica* is widespread, especially in the south-west and southeast. In south-western Romania it has been detected in the Danube and Sohodol Gorges, since 1870, in various forms: *P. lusitatica*, *P. lusitatica* var. *chersonensis*, *P. chersonensis*, *P. serbica* (Păun *et al*., 1970; Păun and Popescu, 1970). It is known in Dobrogea from the central (Gura Dobrogei; Cheia) and southern regions (Canaraua Fetii Forest/Forest Reserve; Esechioi Forest Reserve; among rocks of Independența; in the Snakes Valley of Hagieni Forest; and among rocks, on banks and near sulphurous waters from Mangalia, near Tatlageac Lake) (Andrei and Popescu, 1966; Ciocârlan, 2001; Horeanu, 1973, 1976 a, b; Mihai *et al*., 1964).

In the Conacu-Negrești Valley, *P. serbica* was identified in a small canyon ($43^0$59`34,68`` N, $28^0$10`54,25`` E), at the entrance to Conacu Village - in the central eastern part of the valley, with north-western aspect and a limestone wall with north-

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eastly aspect – near the central - west valley (43^{0}58`55,85`` N, 28$^0$09`38,10`` E). The existence of cattle, sheep and goat herds may endanger the future existence of this species. There, it co-occurs with: *Asplenium ruta-muraria* L. (Polypodiaceae), *Minuartia bilykiana* Klokov in Kotov (Caryophyllaceae), *Sanguisorba minor* subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. & C. Navarro (Rosaceae) and other species.

P. serbica have a considerable scientific importance due to its extreme rarity and small range in Europe. The species has practical importance as an herb with the same therapeutic properties as *Parietaria officinalis*.

P. serbica is a short, annual species that grows in small populations in rocks caverns, with low power propagation. It is a plant that needs to rebuild their herd seasonally. All this shows the degree of endangerment of the species. Conservation measures include: prevent quarrying in its habitats, its conservation within protected areas, conservation of seeds in gene banks and growning the species in botanical gardens. In Romania is present in protected areas the Porțile de Fier Natural Park and Sohodol Gorges in southwestern Romania, and in Hagieni Forest, Canaraua Fetii, Gura Dobrogei, Cheia Natural Reserves in the territory of Dobrogea.

Dianthus pseudoarmeria M. Bieb. is a annual-biennual plant, short hairy, and without vegetative shoots. It has dense array of pink flowers, with sexual reproduction through direct entomophilous pollination and well as anemophily, and through zoochory („eating“ seeds by animals and their dissemination through faeces material). It blooms in June-July. *D. pseudoarmeria* is a heliophyte, termophyte, calciphili species (Dihoru and Doniță, 1970).

In Romania, it has been detected in Dobrogea and the Hanu Conachi (Galati). In Dobrogea, it has been detected on Măcin Mountain, to Greci, to Cerna, on Pricopan Hill; to Babadag-Caugagia; the Dolojman Peninsula and on Saele Litoral Dunes (last, located in the Danube Delta Biosphere Reserve); the Histria Ancient City; on Capidava Hill; to Hârșova; to Medgidia; to Basarabi; in the Hagieni Forest, in southern of Cotul Văii, in Mare Valley and in Topolog Valley (Cristurean and Ionescu-Țeculescu, 1970; Prodan, 1935).

In Conacu-Negrești Valley, *D. pseudoarmeria* was identified on a south - facing limestone wall in the north-western portion of the valley (44^{0}00`21,29`` N, 28$^0$08`51,34``). It also was reported on a grassy hill at the bottom of the lake, in the south-west (43^{0}58`38,28`` N, 28$^0$10`15,43`` E) and in the large canyon in the south-west of the valley (43^{0}58`03,98`` N, 28$^0$10`30,27`` E). In these settings, it co-occurs with: *Achillea setacea* W. et K., *A. coarctata* Poir and *Carduus thoermeri* Weinm. (Compositae), and other species.

It is an important ornamental plant and is grown in flower gardens.

Currently, *D. pseudoarmeria* is listed within the territory of protected areas, including: Hanu Conachi, Hagieni, Fântânița-Murfatlar, Măcin Mountain National Park, Danube Delta Biosphere Reserve. This species deserves protection due to habitat loss, and because it is parasitized by microbial fungi. *"Ex situ"* cultivation could be achieved in botanical gardens.

Minuartia bilykiana Klokov in Kotov (syn. *M. tenuifolia*) (Figure 3 C) is a low-growing, glandulous, annual plant, less than 10 cm tall. It is patent-branched and reproduces sexually through entomophily, and with anemochory and zoochory dispersal. The stamens mature before the stigmatas. *M. bilykiana* presents hermaphroditic flowers,

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with female reproductive organs mature before the male reproductive organs. It blooms from May-July.

It is a plant of hills, a heliophytic, thermophyte, who living on dry soils that are low in nitrogen, and in xerophytic meadows and on rocks (Zahariadi, 1965).

In Romania, it has been documented thus far only in Dobrogea northeast of the town of Baia, Agighiol and Dolojman Peninsula, between 1966 and 2000, by Romanian botanist Gavril Negrean. In central and southern Dobrogea, it was identified, between 1961-2004, by the same botanist in north of the town of Topalu; on Allah-Bair Mountain; in the Seid-Orman Valley, near the towns of Târgușor and Palazu Mic; to Basarabi, Fântânița; to Techirghiol; in Hagieni Forest, Snakes Valley; to Mangalia, and the south-southeast of Cotul Văii, Mare Valley, „la Ic". In 1930 and 1933, Romanian botanist E. I. Nyárády identified this species on Allah-Bair Mountain and in Chirișlic, as *Minuartia villosa*. Romanian botanist C. Zahariadi botanized at two resorts in southern Bassarabia (now Moldova Republic)), in 1929 and 1933, identifying it as *Minuartia tenuifolia*. In 1965, he synonomized *M. tenuifolia* with *M. bilykiana*.

In Conacu-Negrești Valley, *M. bilykiana* was identified on a southeast – facing limestone wall in the central valley ($43^0$59`39,02`` N, $28^0$10`38,98`` E). It also has been identified in the small canyon ($43^0$59`34,68`` N, $28^0$10`54,25`` E), located in the entrance of Conacu Village. It co-occurs with: *Satureja coerulea* Janka (Labiatae), *Ornithogalum oreoides* Zahar. (Liliaceae), and other species – on the limestone wall, and with: *Asplenium ruta-muraria* L. (Polypodiaceae), *Sanguisorba minor* subsp. *balearica* (Bourg. ex Nyman) Muñoz Garm. & C. Navarro (Rosaceae), *Parietaria serbica* Panč. (Urticaceae), and other species – in the small canyon.

Its scientific importance is quite high because it is a rare and ephemeral species, requiring future taxonomic research.

It requires protection because of reduced habitat availability and because it is parasitized by species of microbial fungi. As a conservation measure, *"ex situ"* cultivation in botanical gardens would help protect this species.

Silene exaltata Friv. (syn. *Otites exaltata* (Friv.) Holub.) is a biennual to perennial plant species up to 2 m tall, with sexual reproduction and with entomophilous pollination and with anemochory dispersal. *S. exaltata* blooms from May to July and it is a heliophytic, thermophyte that lives on dry, neutral soils, on limestone slopes.

In Romania, *S. exaltata* been identified thus far only in Dobrogea. It was reported between 1978 and 1983 by the Romanian botanist Gavril Negrean in the northern Dobrogea: on the Sărăturile Coastal Dunes from Sfântu Gheorghe, east of Enisala Ancient City, in the southeastern Heraclea Ancient City, north of „Caramanchioi" and on Dolojman Peninsula. In southern Dobrogea, it was detected in Agigea, Basarabi and in the Hagieni Forest (in "Cascaia"). Currently, *S. exaltata* is protected within Danube Delta Biosphere Reserve, Fântânița-Murfatlar Forest, Maritime Dunes Reserve from Agigea and Hagieni Forest. In Wrigley`s opinion, this species replaces *S. chersonensis* from north of the Danube River, in Romania.

In Conacu-Negrești Valley, *S. exaltata* was identified on the limestone plateau ($43^0$59`19,11`` N, $28^0$19`42,60`` E), in the centre of the valley where agriculture on the southern and eastern sides may threaten this species. It also has been identified in the small canyon in the south-west of the valley ($43^0$58`18,04`` N, $28^0$10`11,11`` E), a

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canyon with expanded population of *Ailanthus altissima* (Mill.) Swingle - "cenușerul" (Simaroubaceae), a invasive species that is native to eastern Asia. This endangers the existence of *S. exaltata* and other native plant species existing in the small canyon. It co-occurs with: *Satureja coerulea* Janka (Labiatae), *Ornithogalum oreoides* Zahar. (Liliaceae), and other species – on the plateau, and with: *Dianthus armeria* (Caryophyllaceae), *Campanula bononiensis* L. (Campanulaceae), *Asperula tenella* Heuff. ex Degen (Rubiaceae), and other species – in the small canyon.

It is a threatened species due to its reduced habitat area and attack by parasitic microbial fungi.

The scientific importance of this species is quite large due to its taxonomic relation to the *Otites* group in Romania and in relation to its corology/arealography as a European species.

Jasminum fruticans L. is a shrub with evergreen leaves, up to 3 m in height, with 4-angular branches; alternate leaves with three-leaflets and yellow flowers. The plant is pollinated by insects and dispersed by zoochory. It blooms from May to July. According to Tarnavschi and Diaconescu (1965), *J. fruticans* is a heliophytic, thermophyte species that occurs on dry, pH neutral and low nitrogen soils, unassuming plant to the substrate, but sensitive to frost. In Hagieni Forest Natural Reserve (Dobrogea), this species occurs with shrubs on steep slopes, including *Carpinus orientalis* („cărpiniță"), *Paliurus spina-christi* („păliur"), *Crataegus monogynae*, *Achillea clypeolata*, *Asparagus verticillatus*, *Asphodeline lutea*, *Ononis pusilla* and *Salvia ringens*.

In Romania, this species is widespread only in central and southern Dobrogea. To date, it has been found near the Cernavodă, Medgidia, Basarabi, Fântâna Mare, Gura Dobrogei towns, south of Mircea Vodă Station, north of Şipote, north of Mangalia, south-southeast of Cotul Văii, 2 Mai Village, in Seid-Orman and Stârghina Forests. Also, after Morariu (1961), it found on the territory of nature reserves: Cheia Jurrasic Reefs Nature Reserve, the Fântânița-Murfatlar Reserve, Dumbrăveni Forest, the „Canaraua Fetii" and „Esechioi" Forest Reserves, and the Hagieni Forest (Borza, 1944; Parincu *et al*., 1998).

In Conacu-Negreșt Valley, it was identified only on the southeast facing limestone, in the central valley ($43^0$59`39,02`` N, $28^0$10`38,98`` E). There, it co-occurs with: *Crataegus monogyna* Jacq. (Rosaceae), *Prunus spinosa* L. (Rosaceae), *Achilea coarctata* and *Centaurea napulifera* Roch. (Compositae), *Satureja coerulea* Janka (Labiatae), *Ornithogalum oreoides* Zahar. (Liliaceae), and other species. The existence of the species in this valley is endangered due to several invasive species including: *Gleditshia triacanthos* L. Leguminosae), *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae), *Elaeagnus angustifolia* L. (Elaeagnaceae).

By Boșcaiu (1976), the plant has a great scientific importance due to its highty isolated range, which indicate its great age.

It also is threatened by its small populations, lack of suitable habitat, impacts of parasitic microbial fungi. These factors indicate that specific conservation measures should be undertaken, including both *"in situ"* and *"ex situ"* propagation options.

Satureja coerulea Janka in Velen (Figure 3 D) is a sub-shrub up to 25 cm tall, with deep roots; hairy stems and linear, ciliate leaves what are 1,5-2 mm wide. This species has pink fowers 7-10 mm wide, is self-pollinated and its fruits and seeds are disseminated by zoochory. *S. coerulea* blooms from July to September.

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S. coerulea is a heliophytic, thermophytic, calciphile and is ultra-xerophyle species who occurs on dry, neutral soils, on hills, in arid rocks meadows, and on rocks.

In Romania, this species is widespread only in Dobrogea. To date, it has been reported from the Măcin Mountains, the Babadag Plateau, the Urlichioi, Limanu, Adamclisi and Sevendic Valleys, on the southern shore of Tatlageac Lake, to Basarabi, Negru Vodă, Cheia, Casian, Gura Dobrogei, Palazu Mic, Castelu, Medgidia, Mangalia and Adamclisi. According to Burduja and Horeanu (1976), Mihăilescu–Firea *et al*. (1965), Morariu (1970), Răvăruț (1961), Țopa and Marin (1981), it is found within several protected areas: the Măcin Mountains National Park, the Cheia Jurassic Reefs, the Fântânița-Murfatlar Forest, the Hagieni Forest and the Dumbrăveni Forest (Țopa and Marin, 1968, 1970, 1973).

In Conacu-Negrești Valley, *S. coerulea* was identified on the southeast facing limestone wall ($43^0$59`39,02`` N, $28^0$10`38,98`` E) and on the limestone plateau ($43^0$59`19,11`` N, $28^0$19`42,60`` E), both located in the central valley. Here, it co-occurs with: *Crataegus monogyna* Jacq. (Rosaceae), *Prunus spinosa* L. (Rosaceae), *Jasminum fruticans* L. (Oleaceae), *Achilea coarctata* and *Centaurea napulifera* Roch. (Compositae), *Minuartia bilykiana* Klokov in Kotov (Caryophyllaceae), *Ornithogalum oreoides* Zahar. (Liliaceae), and other species. In this valley, the species is endangered by non-native species: *Gleditshia triacanthos* L. (Leguminosae), *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae), *Elaeagnus angustifolia* L. (Elaeagnaceae).

The plant has practical importance as a decorative species and of importance in bee-keeping for its melliferous nectar production (Dihoru & Negrean, 2009).

Although, it is conserved within protected areas, as mentioned above, *S. coerulea* requires aditional conservation measures, both „in situ“ and „ex situ“, including cultivation in botanical gardens and population restauration. Such actions are warranted because it tipically forms small populations and its rock surface habitats has been reduced.

Achillea clypeolata Sibth. et Sm (syn. *A. alexandri-borzae* Prodan) (Figure 4 A) is a perennial plant with leaves in one plane, larges incisions that reach the median rib; inflorescences with peduncles 2 mm long, yellow flowers; sexual vegetative reproduction, with many stems growing from a single root; entomophilous and anemophilous pollination, and dispersal of fruits and seeds in its habitats. It blooms from June to July. It preserved well by vegetative reproduction by rhizomes. By yellow flowers and compact inflorescences, the species can be confused with *Achillea coarctata* Poiret and with *Achillea thracica* Velen. This latter species is a European endemite, a Dobrogean-Thracian element with potential for existence in the valley. *A. clypeolata* hybridizes with *Achillea neilreichii*, *Achillea setacea*, and *Achillea pannonica* (the first species identified in the valley), demostrating the vigurous nature of this species (Prodan, 1931, 1939a, b). *A. clypeolata* is a heliophytic, thermophyte what occupies dry, neutral soils, in arid meadows.

A. clypeolata is a European endemit to Albania, Bulgaria, Greece, Serbia, Muntenegru, Romania, and Turkey, according to Richardson (1976). In Romania, this species is widespread only in Dobrogea. To date, it has been identified from Babadag, Jurilovca, Ceamurlia de Sus, Mangalia and the Coroanei Valley, Cotul Văii (Mare Valley, in the south) and Allah-Bair Hill, although subsequent searches have failed to detect it there. After Mititelu *et al*. (1968), Prodan and Nyárády (1964), it is

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present in the Hagieni Forest Reserve (Ciocârlan and Costea, 1997; Prodan, 1930). In Conacu-Negrești Valley, it was found only on the limestone plateau located in the central valley ($43^0$59`19,11`` N, $28^0$19`42,60`` E). There, it co-occurs with: *Achillea setacea* W. et K. and *Echinops ritro* L. ssp. *ruthenicus* (M. Bieb.) Nyman (Compositae), *Salvia nutans* L. (Labiateae), *Allium saxatile* MBieb. (syn. *Allium globosum* MBieb ex DC) (Liliaceae). A agricultural practice to the west, southwest, southeast and east sides, endanger the future existence of this species.

The plant is economically important, as a decorative plant, and has been identified as important to the plant genetic fund. In addition, it has scientific importance as it reaches the north-eastern limit of its limited world range. Because of the reduction of Dobrogea steppes habitats by plowing and because it is parasitized by the microbial fungi, this species requires additional conservation protection.

Centaurea napulifera Rochel (Figure 4 B) is a short, perennial plant, only10-15 cm tall, what spreads by rhizomes and sometimes runners. It has thickened roots, leaves with "felt" (tiny) white-silver hairs, on its lobe-shaped or lyre-shaped, basal leaves arranged in a rosette. *C. napulifera* undergoes vegetative reproduction via its long, thin runners. It reproduces sexually, with both anemophilous and entomophilous (by ants) pollination. This species blooms in April-May. According to Dihoru *et al*., (1965), two subspecies of *C. napulifera* are recognized in Romania in Flora Europaea: *C. napulifera napulifera* and *C. napulifera thirkei* (Schults Bip.), and two forms: *tuberosa* (Vis.) Gugler and *albiflora* Prodan. It is endemic species in Europe (Bulgaria, Greece, Serbia, Muntenegru, Romania, Moldova, Turkey), according to Dostál (1976).

In Romania, this species is widespread only in Dobrogea. To date, it has been detected in the Consul Mountain and on Denis-Tepe Hill, from the Casimcea Plateau and Caugagiei Valley, at the base of Slovan-Bair Hill, from Casimcea, Seidorman, Tatlageac, Sevendic Valleys, and from Basarabi, Mangalia, Adamclisi, Medgidia, Valul lui Traian, and 23 August Village. After Dihoru (1965), Horeanu (1975) and Morariu (1970), it is found within the following protected areas: the Cheia and Fântânița- Murfatlar Reserves, the Dumbrăveni and Hagieni Forests, Valul lui Traian, Allah-Bair Hill, Consul Hill, and Măcin Mountain National Park (Zahariadi and Negrean, 1969).

C. napulifera is a heliophytic, thermophytic, calciphile, a xerophytic species that lives on dry, neutral-pH soils. Species grows in green lands with rare trees, on dry meadows, and by bushes. In the Conacu-Negrești Valley, it was found only on the limestone plateau located in the central valley ($43^0$59`19,11`` N, $28^0$19`42,60``E). There, it co-occurs with: *Achillea setacea* W. et K. and *Echinops ritro* L. ssp. *ruthenicus* (M. Bieb.) Nyman (Compositae), *Salvia nutans* L. (Labiateae), *Allium saxatile* MBieb. (syn. *Allium globosum* MBieb ex DC) (Liliaceae).

C. napulifera is a vulnerable species due to agricultural alteration of its habitat in the west, southwest, southeast and east sides of the study area.

This species has considerable scientific importance because its unusual life history characteristics particularly is vegetative reproduction and short life cycle. It also has practical importance as a decorative plant and for its nectar and pollen production during spring.

The plant is endangered in part due to its short stature, which does not allow for widescale dispersal of fruit (usually only a few cm), and it may be attacked by microbial fungi. To these threats are added

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the impacts of intensive livestock grazing and other agricultural alternation of its natural grassland habitats.

Consequently, protective measures are needed, including research, resolution of its subspecific taxonomic, and propagation in protected settings, including botanical gardens.

Scolymus hispanicus L. (Figure 4 C) is a thorny and hairy biennual to perennial species. It was divided basal-leaves, basal leaves and petiolate, sessile leaves - on the stem and yellow flowers. *S. hispanicus* reproduces sexually, with anemophilous and entomophilous pollination, and dissemination of fruit and seeds through anemochory and gravity. It blooms from June-August, according to Nyárády (1965) and Walters (1976).

It is a heliophytic thermophyte that lives on dry, nitrogen rich soils, on cliffs, and in ruderal settings.

In Romania, this species has been detected thus far only in Dobrogea and occasionally, localy near Sibiu and Giurgiu (where it was reported as adventitious). In Dobrogea, it was detected in the coastal zone (Sulina, north of Periboina to Portița, Chituc and Saele Litoral Dunes –Danube Delta; Midia Peninsula; "3 Papuci" Beach, south of Constanța; Agigea; Eforie Nord; Eforie Sud; Tuzla; Mangalia; 2 Mai and Vama Veche Villages; Tatlageac and Techirghiol Lakes), of north (Măcin) and of south of Dobrogea (Sevendic Valley; Limanul Valley, Mare Valley –south-southeast of Cotul Văii, Hagieni Forest) (Dihoru and Negrean, 1976; Ionescu-Țeculescu and Cristurean, 1967; Morariu, 1963, 1965).

In the Conacu-Negrești Valley, it has been detected on the southeast facing limestome wall in the north-west valley ($44^0$00`21,29`` N, $28^0$08`51,34`` E) and on the eastern shore of Conacu-Negrești Lake, between Conacu Village and terminal side of the lake ($43^0$59`07,38`` N, $28^0$11`02,90`` E).

It is widespread from southern Europe up to northern France (Albania, Azores, Baleares Islands, Bulgaria, Corsica, Crete, France, Greece, Spain, Italy, Serbia, Muntenegru, Portugal, Romania, Ukraine, Sardinia, Sicity, Turkey), according to Walters (1976).

It is a plant with practical importance, as a medicinal herb. It is used as a diuretic and a treatment for eczema and liver failure; it also is used as a ornamental and a food plant.

The species is characterized by small populations and therefore is threatened by loss of habitats. For these reasons, this species needs protection, both „in situ" (currently, there is within Danube Delta Biosphere Reserve) and „ex situ" (through cultivation in botanical gardens).

Ornithogalum oreoides Zahar. (Figure 4 D) is a rhizomatous plant, with bulbs with free scales, canaliculate leaves that are smooth edgeds. It is polinated by insects and its fruit and seeds are disseminated by gravity; however, it also undergoes vegetative reproduction. According to Zahariadi (1980), *Ornithogalum oreoides* blooms in May.

It is a heliophytic, calciphile, and is a subxerophytice species.

In Romania, this species has been reported thus far from Dobrogea and in refugia in other parts of Romania. In Dobrogea, it was found to Caraorman litoral sands from the Danube Delta, on the Babadag Plateau, and in „Canarale" from Hârșova, Gura Dobrogei, the Cheia Reserve, on Allah-Bair Hill, in the „Canaraua Fetei" and in the „Esechioi"Forest Reserves, and elsewhere (Ciocârlan, 1994; Lungeanu, 1972).

O. oreoides was detected in the Conacu-Negrești Valley only on the limestone

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plateau located in the central valley ($44^0$00`21,29`` N, $28^0$08`51,34`` E).
Although an important ornamental and nectar producing species, it is a rare and is highly restricted to specific microsites, and may be attacked by fungi. Consequently, it deserves protected measures, both "in situ" (currently, it is in the territory of Cheia Jurassic Reefs Reserve, „Canaralele" from Hârșova Port, Gura Dobrogei Cave, and the Danube Delta Biosphere Reserve) and "ex situ" (through cultivation in botanical gardens and through restocking).
Koeleria lobata (M. Bieb.) Roem. & Schult. (syn. *K. brevis* Steven; *K. degenii* Domin) is a perennial brush-shaped plant, sometimes forming small clusters. It has bulbous root base and many stems emerge from single root. Along with its vegetative reproduction capacity, it is amemophilous and its seeds are dispersed by gravity and by „seed eating" animals. It blooms from May-July.
K. lobata is a heliophytic, thermophytic, calciphile, an ultraxerophytic species that grows on dry, pH-neutral soils (Andrei *et al*., 1965).
In Romania, this species has been reported only from Dobrogea: in the Lupilor Litoral Dunes, the Letea Forest, Razim Lake, the Dolojman Peninsula from Danube Delta, Carvan Hill, the Babadag Plateau, the Măcin Mountains, Gura Dobrogei, Cheia Reserve, Valul lui Traian, Fântânița-Murfatlar, the Snakes Valley from Hagieni Reserve, and in south-southeast of Mare Valley from Cotul Văii (Sârbu *et al*., 2000).
In the Conacu-Negrești Valley, it was detected on a limestone wall (alt. 89 m) from the bottom of the lake in the south-central valley, on south-eastern exposure ($43^0$58`53,66`` N, $28^0$10`09,29`` E). Its presence is confirmed in the large canyon, on the limestone wall in the northwest valley and on the limestone plateau above the canyon, where co-occurs with *Parietaria*.
This species is a vulnerable due to loss of its habitats, and it is of scientific interest because of its vegetation reproduction. It also is a pioneer species, stabilizing rocky lands.
Protective measure are necessary, including "in situ" through preservation in reserves, such as the Hagieni Forest, Fântânița-Murfatlar, the Babadag Forest, the Uspenia Monastery, and Măcin Mountains National Park. It also may require "ex situ" protection through cultivation in botanic gardens.
According to the IUCN, among the plant species analyzed in this paper, 7 are vulnerable species, 2 are threatened species, 1 are critically endangered species, and 2 species have a low risk of threat. The biogeography data analysis shows that the Continental, Scythian and Mediterranean biogeoelements dominate with 2 taxa each. There are also 6 European endemics (Table 2).

Conclusions: Data presented in this work were compiled from field and laboratory studies in 2003–2015. This research is part of a program developed by the "Monachus" Group for Research and Environmental Education in Constanța, Romania, aimed at identifying the geo-biodiversity of the Conacu-Negresti Valley, the geology, paleontology, biology and ecology of which was not recognized until 2003.
Our field and laboratory studies lead us to conclude that the Conacu-Negreşti Valley is characterized by a rich and diverse flora and fauna, with numerous rare and endemic species for Romania and Dobrogea. Many of these species require improved management, protection, and preservation status. At present, the valley does not have designated conservation status.
Human impacts on different aspects may contribute to future declines and even disappearance of some rare species.

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Therefore, urgent protective measures should be taken that will lead to improved geo-biodiversity conservation and landscape protection in this valley.
Due to its unique nature, which result from its geological and paleontological past, the valley hosts many species important to science and human well-being, and some of which have not yet been described. Such efforts will be the focus of future work in this research program.

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