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INVASIVE NATIVE PLANTS IN ANTHROPOGENIC ECOSYSTEMS FROM OLTENIA, ROMANIA

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Abstract

Oltenia is located in the southwestern part of Romania, between the Danube, the Olt and the Southern Carpathians. The anthropogenic ecosystems in this part of the country are represented by those areas where human intervention is partial or total. These are confined from the plain to the Sub-Carpathian depressions. In Oltenia, there are to be found anthropogenic ecosystems comprising orchards, vineyards, protected crops (vegetables and flowers), as well as those of human settlements (rural and urban). Some spontaneous species found in these ecosystems are native plants that have shown an increased invasive potential in recent years. The analysis of data collected from the field shows an affinity of some species for certain anthropogenic ecosystems (ex. Calamagrostis epigeios (L.) Roth, Daucus carota L., Elymus repens (L.) Gould - for the orchards; Stellaria media (L.) Vill., Lamium purpureum L., Veronica hederifolia L., V. polita Fr., Senecio vernalis Waldst. et Kit. – for the viticultural ecosystems; Digitaria sanguinalis (L.) Scop., Cirsium arvense (L.) Scop., Sinapis arvensis L., Portulaca oleracea L. – for vegetable crop areas); Cardaria draba (L.) Desv., Capsella bursa pastoris (L.) Medik., Hordeum murinum L., Onopordum acanthium L. - for the human ecosystems. On the other hand, there are certain species found in almost all types of anthropogenic ecosystems: ex. Cynodon dactylon (L.) Pers., Convolvulus arvensis L.

Key words*: crops, invasive, native plants, Oltenia, Romania.*

INTRODUCTION

The plant world is the result of a long evolution, closely related to changes in the configuration of land, seas, relief, living conditions, as well as to the penetration of new species from neighboring areas, the migration or disappearance of old species and the evolution of other species (Cosmulescu, 2008).

Anthropogenic ecosystems have a specific structural and functional diversity that reflects the variety of ecological conditions, especially those related to climate and soils. The category of anthropogenic ecosystems within Oltenia includes orchards, vineyards, vegetable and flower farming areas, as well as those in the proximity of rural and urban settlements.

The anthropogenic ecosystems within Oltenia are characterized by a floristic variability during the vegetation period, which depends on latitude, altitude, exposure, microclimate conditions, soil type, water regime, temperatures, etc. If the distribution of anthropogenic ecosystems in Oltenia is regarded in the framework of the Romanian vegetation areas and vegetation levels, we can state that the former are encountered from the steppe area to the nemoral level (that of deciduous forests).

The spontaneous flora of the anthropogenic ecosystems located in this part of Romania is varied, with a high phytodiversity especially characteristic to the neglected or abandoned ecosystems.

Data on the presence of these species in different areas of Oltenia can be found in numerous floristic and vegetation studies (Buia, 1952; Păun, 1964; Costache, 2005).

Some of them are non-indigenous adventitious species (Dihoru, 2004; Costache and Răduțoiu, 2005; Răduțoiu, 2011).

The influence of climate changes during recent times has led to important modifications in the floristic composition of these ecosystems, resulting in the significant development of some native species that show invasive potential.

Invasive species are a form of “biological pollution” (McNight, 1993).

Invasive plants have drawn the attention of specialists since the 1980s, this fact being proved by the publication of several specialized papers (e.g. Drake et al., 1989; Groves & di Castri, 1991; di Castri et al., 1990; Pyšek,

1995; Pyšek et al., 2003; Carey et al., 1996; Răduțoiu & Costache, 2008; Răduțoiu & Stan, 2013).
Worldwide cultivated and spontaneous plants are affected by different biotic and abiotic constrainers, limiting their yielding capacity and adaptability in the areas affected by climate change effects (Paraschivu et al., 2020; Paraschivu et al. 2021; Velea et al., 2021; Durau et al., 2021; Paraschivu & Cotuna, 2021).
Useful information on the floristic composition of anthropogenic ecosystems can also be obtained by means of drones, which are already used in collecting data for forestry and agriculture (Călina et al., 2020).

MATERIALS AND METHODS

Numerous fieldtrips were made to different anthropogenic ecosystems in Oltenia in order to conduct this study, namely to observe the syndynamics of the spontaneous vegetation in these areas. In addition to the invasive alien species identified in the studied areas, there were observed native species that show an invasive potential in certain anthropogenic ecosystems. This has been identified especially in relation to the crops that are not properly maintained. Plant identification was performed by using the specialized literature (Ciocârlan, 2009; Sârbu et al., 2013).
The presentation of each analyzed plant comprises: the scientific name, the common name, the botanical family to which it belongs, the lifespan, the anthropogenic ecosystems where it was identified in numerous specimens, the manner of spread that favored its abundant development and possible biological control measures.

RESULTS AND DISCUSSIONS

Following the research conducted over several years within various anthropogenic ecosystems, there have been identified native plants that successfully compete with alien ones for the status of invasive species in Romania.
The degradation of certain anthropogenic ecosystems has enabled the installation and development of numerous native species that have noticeably proliferated, some becoming invasive, due to the fact that they have benefited from the reduced competition from these areas.
Significant elements in the category of native species that show invasive plant potential for different anthropogenic ecosystems in Oltenia are presented below.
Calamagrostis epigeios (L.) Roth - Wood small-reed. (Fam. Poaceae) - is a plant native to Central Europe, unpretentious to the substrate on which it grows, being found in numerous orchard ecosystems, tailings and ash dumps, neglected or abandoned orchards located in the plain region and up to the Sub-Carpathian hills. The presence of a very well-developed rhizome system and the high capacity of fruit spreading are some aspects that lead to an abundant development, which is almost exclusive on the areas where it begins to grow. It is used for grazing only in the early stages of vegetation because the mature plant has a well-developed sclerenchyma on the vegetative organs and an abundant hairiness that makes it undesirable for the herbivores.
Repeated mowing is recommended before the fruit ripening stage, in order to deplete the rhizomes in the soil.
Capsella bursa pastoris (L.) Medik. - Shepherd's purse. (Fam. Brassicaceae).
It is an annual spring or autumn species, native to Europe, frequently encountered in the rural and urban ecosystems, within orchards, but also in vegetable gardens. Due to a long anthesis that can sometimes last throughout the yearly vegetation period, to the massive seed production and to a low forage value, the plant easily spreads and even becomes monodominant on certain areas. Although it is known as a medicinal plant, in Oltenia it is regarded as a harmful weed and it is not used by the locals.
Destruction before fruit development is recommended in order to control this plant.
Cardaria draba (L.) Desv. - Whitetop. (Fam. Brassicaceae).
It is a perennial species, native to Europe, with invasive potential; in bloom, it contributes to the aesthetics of the place where it vegetates and it emits a pleasant scent. It has a high ecological plasticity, which gives it a significant resistance to environmental conditions.

The large number of specimens found along the transport network within rural and urban areas is due to the great number of seeds produced by phytoindividuals of this species and to the high propagation capacity through the shoots on the roots (Dihoru, 2004). In some anthropogenic ecosystems it is considered a harmful weed. There are many active substances that can fight this species.

Cirsium arvense (L.) Scop. - Creeping thistle. (Fam. Asteraceae).

It is a quarantine weed, native to all of Europe, Western Asia and Northern Africa and it is found in almost all anthropogenic ecosystems in Oltenia, from the plain region to the vegetable gardens located near the sheepfolds in the mountains. The massive presence of the plant on certain areas is favored by the easy spreading of its fruits and by the vegetative reproduction through the buds on the roots, the creeping thistle being among the few species that develop shoots from the roots. It is collected only during the vegetative stage by some locals, being used for pig feeding.

Repeated cutting off at ground level is recommended before flowering, in order to deplete the underground part of the plant, as well as to significantly reduce the number of seeds.

Daucus carota L. - Wild carrot. (Fam. Apiaceae).

It is an annual winter plant, native to temperate regions of Europe and Southwestern Asia and naturalized in North America and Australia. In Oltenia, it is invasive especially in the orchard ecosystems located within the Piedmont and the Sub-Carpathian hills.

The development of a large number of plants is favored by the irrational grazing conducted on these areas and by the easy fruit spreading (either through the wind or through domestic animals, to which it readily attaches). Mowing before fruit development in conjunction with rational grazing could mitigate the spread of this species.

Digitaria sanguinalis (L.) Scop. - Hairy crabgrass. (Fam. Poaceae).

It is an annual summer species, probably native to Europe (Pl@ntNet), known as the "common weed" in almost every country in the world; it is readily recognized by its inflorescence. Due to this plant's preference for areas characterized by high temperatures during the growing season, it is invasive only in the plain region of Oltenia, in vegetable crops grown on light-textured, xeric, weakly acidic soils. In the anthropogenic ecosystems of the Getic Piedmont and of the Sub-Carpathian hills, this species is present through isolated specimens.

Elymus repens (L.) Gould - Couch grass. (Fam. Poaceae).

It is a plant native to most of Europe, Asia, the Arctic biome and to the Northwestern Africa. It is frequently encountered in poorly maintained orchard and vineyard anthropogenic ecosystems, as well as on the edge of the well-kept ones and on the outskirts of rural settlements. The perennity of this species is mainly due to the very well-developed rhizome system, which is the origin of stolons. The plant eliminates any species with which it initially coexists and it forms monodominant surfaces. As it is a plant that resists rather well to water stress, some of the local people use it in animal feed during the dry periods of the year. It is sensitive to many herbicides.

Hordeum murinum L. - Wall barley. (Fam. Poaceae).

It is an annual species, common in most regions of Europe, which develops massive populations in the same typical areas as *Cardaria draba*. The wild rodents that collect the fruits for the unfavorable periods of the year and the ease with which the ripe fruits attach on animals or human clothing represent important contributing factors to the spread of this plant. Accidentally and in a small number of specimens, the plant is also encountered in orchards, vineyards or vegetable crop ecosystems.

It is used in the plain region of Oltenia as fodder for cattle during the dry periods of the year.

Lamium purpureum L. - Purple dead-nettle. (Fam. Lamiaceae). It is an annual species, native to Europe and Asia, which becomes invasive in almost all vineyard ecosystems in Oltenia and sometimes even in the vegetable gardens. In spring, before the development of the foliar apparatus of the crop plants, it gives the aspect of the grass layer within the cultivated areas. The development of a large number of plants in certain anthropogenic ecosystems in Oltenia is also favored by the

long anthesis, which lasts from March to October. The only advantage that *Lamium purpureum* can bring to the coexisting crop plant consists in attracting the pollinating insects.

Onopordum acanthium L. - Scotch thistle. (Fam. Asteraceae).

It is a biennial plant, native to Europe and Western Asia, characteristic of the ecosystems located near the rural and urban settlements. It prefers nitrophilous areas, which it colonizes until full flowering, due to its robust general aspect. On the areas where it settles, the plant becomes monodominant and it eliminates almost all the species with which it coexists in the first stages of development. Its abundant hairiness, the presence of thorns on the edges of laminas and the easy spreading of the fruits, make this plant an "enemy" of the diversity of places where it grows.

It is invasive only in the plain and piedmont region of Oltenia; otherwise, the species is present only through sporadic individuals.

Portulaca oleracea L. - Common purslane. (Fam. Portulaccaceae).

It is an annual plant, with extensive distribution, which is present in almost all anthropogenic ecosystems in Oltenia, but it has the highest frequency in vegetable crop ecosystems, where it sometimes becomes invasive and develops vigorous specimens. The specialized literature includes these surfaces in the association *Portulacetum oleracei* Felföldy 1942 (Sîrbu, 2004). It prefers light-textured soils, especially the sandy ones. The massive presence in certain areas is facilitated by several factors, i.e.: the large number of seeds that a specimen can produce; the significant germination properties of the seeds of this plant, which can be preserved for a period of three - four years; the high resistance to diseases and pests due to the protective wax layer that covers the vegetative organs. In some cases, this plant is known to have antifungal properties (Banerjee & Mukherjee, 2002).

The local people avoid consuming this plant, although it is a rich source of alpha-linoleic acid, an essential omega 3 fatty acid, of vitamins C, E, proteins and negligible fats.

Senecio vernalis Waldst. et Kit. - Eastern groundsel. (Fam. Asteraceae).

It is an annual species, native to Southern and Eastern Europe, as well as to Western and Central Asia. It is able to colonize different types of anthropogenic ecosystems (Brandes, 2003; Hantsch et al., 2013; Kostov & Pacanoski, 2007; Schmiedel et al., 2014; Stevanovič et al., 2007). It is present within an area extending from the Oltenia Plain to the Sub-Carpathian hills, with a higher frequency in the plain region, where it often develops in numerous specimens, especially within the vineyard ecosystems.

During the vernal season, this plant dominates the lanes between the vine rows and it is accompanied by the few spring bulbous plants (e.g. *Ornithogalum boucheanum* (Kunth) Asch., *Gagea villosa* (M. Bieb.) Sweet, *G. lutea* (L.) Ker Gawl.), or by ephemeral vernal species (*Veronica hederifolia* L., *V. polita* Fr., *Stellaria media* (L.) Vill., etc.).

Two of the main reasons that explain the invasive character of this plant in certain vineyard ecosystems within Oltenia are represented by the easy spreading of fruits at full maturity, coupled with the presence of winds during fruit development. In the Southwestern part of Oltenia, it was also identified near the rural and urban areas, especially on surfaces with sandy or gravelly substratum. In the other anthropic ecosystems, it appears under the form of isolated individuals that add to the chromatics of the places.

Sinapis arvensis L. - Charlock mustard. (Fam. Brassicaceae).

It is an annual weed, native to Eurasia, which multiplies through the numerous seeds it produces (between 200 and 1,800 per plant). A large part of the seeds of this plant are included in the soil along with the tillage, forming a genuine "seed bank". The above-mentioned aspect, together with the high germination capacity and the plant's endurance in the competition with other species, support the idea that *Sinapis arvensis* L. will remain a major issue for the anthropogenic ecosystems in which it grows, causing significant damage. In vegetable crops consisting of plants related to it, this weed is a vector for viruses and fungi (Mulligan & Bailey, 1975). The size of the populations of this species is mainly influenced

by climate, as it prefers periods with higher temperatures.

Stellaria media (L.) Vill. - Chickweed. (Fam. Caryophyllaceae).

It is an annual, ephemeral plant, native to the entire European continent. It is typical of the ecosystems located near the rural and urban settlements, but it is also encountered in other anthropogenic ecosystems within Oltenia, especially in the vineyards and vegetable crops, where it becomes exclusive. The specialized literature describes a vegetal association based on this species (*Stellarietum mediae* Prodan 1939, Hadač 1969) (Prodan, 1939). Sîrbu (2004) mentions that the phytocenoses dominated by this species do not harm the vineyards of Cotnari, Iași and Huși; nonetheless, in the anthropogenic ecosystems of Oltenia, the surfaces edified by *Stellaria media* significantly reduce the water regime in the soil, which has consequences on the vegetative and reproductive apparatus of the host plants.

The spring works conducted before fruit development can significantly reduce the areas where this plant is invasive.

Veronica hederifolia L. - Ivy-leaved speedwell. (Fam. Scrophulariaceae).

It represents an annual weed, native to Europe, tropical and temperate Asia, as well as North Africa (Pyšek et al., 2012); it is found in all anthropogenic ecosystems in Oltenia, especially in the viticultural and vegetable farming ecosystems. It prefers skeletal, light, nutrient-rich soils. Among all the annual species of this genus, this plant shows the highest resistance to control measures. In mild winters it can easily survive.

The good propagation of the plant is favored by the high viability of the seeds (about ten years), as well as by the fact that they germinate both in spring and autumn, at low temperatures. It forms genuine "seed banks" in the soils on which it grows.

Veronica polita Fr. - (Fam. Scrophulariaceae).

It is an annual species, common in ruderal and segetal areas within Oltenia. It is an Eurosiberian Southern-temperate species (https://www.brc.ac.uk/plantatlas/plant/Veronica-polita). It is found in almost all anthropogenic ecosystems in Oltenia, but it is invasive only in the vineyards and vegetable crops, mainly within open and sunny areas, where it forms colonies by reseeding. The plant also benefits from early blooming, which takes place before it develops the creeping stems, as it prefers the cold weather from the beginning of spring.

The first flowering specimens in 2022 were observed in February.

The analysis of the invasive native species from the anthropogenic ecosystems within Oltenia reveals the distinct predominance of annual plants (with a value of about 70%) (Figure 1).

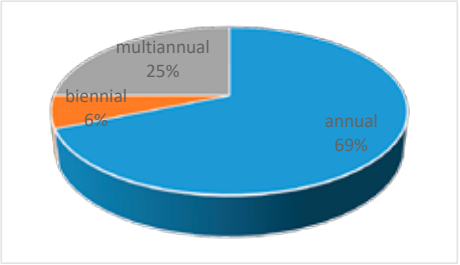

Figure 1. Lifespan analysis of invasive native flora in the anthropogenic ecosystems of Oltenia

CONCLUSIONS

The present paper analyses sixteen species of native vascular plants that are invasive in various anthropogenic ecosystems from Oltenia.

Their number is much smaller as compared to that of the alien species.

The impact exerted by the invasive native species encountered in the anthropogenic ecosystems of this Romanian territory is reflected in the economic loss (manifested either by declining productivity, or by increasing the costs necessary for their control), as well as in the ecological loss. Among these, the annual species are the most aggressive in the areas where they settle, because of the genuine "seed banks" that they form in the soil and of the high germination capacity of their seeds over a longer period of time (sometimes circa ten years - e.g. *Veronica hederifolia*).

REFERENCES

Banerjee, G., Mukherjee, A. (2002). Biological activity of a common weed - Portulaca oleracea L. II. Antifungal activity". *Acta Botanica Hungarica*. 44 (3–4): 205–208.

Brandes, D. (2003). Die aktuelle situation der neophyten in Braunschweig [The actual situation of neophytes in the city of Braunschweig (Germany)]. *Braunschweiger Naturkundliche Schriften* 6(4):705- 760.

Buia, Al., Popescu-Mihăilă, A. (1952). Contribuţii la flora regiunii Craiova. *Buletin Ştiinţific. Secţiunea de Ştiinţe Biologice, Agronomice, Geologice şi Geografice*. Tom. IV. nr. 3: 519-536.

Carey, J.R., Moyle, P., Rejmánek, M., Vermeij, G. (1996). Invasion biology. Biological Conservation 78: 1-214.

Călina J., Călina A., Miluţ M., Croitoru A., Stan I., Buzatu C. (2020). Use of drones in cadastral works and precision works in silviculture and agriculture. *Romanian Agricultural Research*, no. 37: 273-284.

Ciocârlan, V. (2009). Flora ilustrată a României. Pteridophyta et Spermatophyta. Edit. Ceres, Bucureşti, 1042 pp.

Cosmulescu S. (2008). *Ecologia sistemelor antropice pomicole*. Edit. Sitech, Craiova. 311 pp.

Costache, I. (2005). *Flora şi vegetaţia bazinului hidrografic inferior al râului Motru*. Teza de doctorat. Bucureşti. 290 pp.

Costache I. & Răduţoiu D. (2005). The Dynamics of Some Adventive Species and Their Invasive Potential. *Croatian Symposium on Agriculture*. XL. pp. 659-661.

di Castri, F., Hansen, A.J. and Debussche, M. 1990. Biological Invasions in Europe and the Mediterranean Basin. Kluwer Academic Publishers, Dordrecht, 463 p.

Dihoru G. (2004). Invasive plants in Romania's flora. *Annals of the University of Craiova. Biology, Horticulture, Food products processing technology, Environmental Engineering*. IX (XLV): 73-82.

Drake, J.A., Mooney, H.A., di Castri, F., Groves, R.H., Kruger, Rejmánek F.J., Williamson M. (eds.) 1989. *Biological Invasions: a Global Perspective*. SCOPE 37. John Wiley & Sons. Chichester, 525 p.

Durău, C.C., Sărățeanu, V., Cotuna, O., Paraschivu, M., (2021). Impact of the grassland management planning application on some features of the grassland vegetation from Western Romania – Case Study. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, Vol. 21, Issue 3: 325-331.

Groves, R.H. di Castri, F. (eds.) 1991. *Biogeography of Mediterranean Invasions*. Cambridge University Press, Cambridge, 485 p.

Hadač, Em. (1969). Vegetacia C.S.S.R., B2 – Die pflanzen gessellschaften des Tales Dolina Siednich pramenov, in der Belaer Tatra, Bratislava.

Hantsch, L., Bruelheide H., Erfmeier, A. (2013). High phenotypic variation of seed traits, germination characteristics and genetic diversity of an invasive annual weed. *Seed Science Research* 23(1):27-40.

Kostov, T., Pacanoski, Z. (2007). Weeds with major economic impact on agriculture in Republic of Macedonia. Paki*stan Journal of Weed Science Research* 13(3-4):227-239.

McNight, B.N. (1993). *Biological Pollution – The Control and Impact of Invasive Exotic Species*. Indiana Academy of Science. Indianapolis, IN. 261 pp.

Mulligan, G.A., Bailey, L.G. (1975). The biology of Canadian weeds. 8. Sinapis arvensis L. Can*ad. J. Pl. Sci.* 55: 171-183.

Paraschivu, M., Ciobanu A., Cotuna O., Paraschivu M. (2020). Assessment of the bacterium Erwinia amylovora attack on several pear varieties (Pyrus communis L.) and the influence on fruits sugar content. *Scientific Papers. Series B. Horticulture*, vol LXIV, no.1: 163-168.

Paraschivu, M., Cotuna, O., Paraschivu, M., Ciobanu A., Oltenacu, C.V. (2021). Infection of Erwinia amylovora on different apple varieties and the impact on fruits quality. *Scientific Papers. Series B, Horticulture*. Vol. LXV, No. 1: 219-227.

Paraschivu, M., Cotuna, O. (2021). Considerations on COVID 19 impact on Agriculture and Food Security and forward-looking statements. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, Vol. 21, Issue 1: 573-581.

Păun, M. (1964). *Flora şi vegetaţia raionului Balş, reg. Oltenia.* Rezumatul tezei de doctorat. Craiova. 34 pp.

Prodan, I. (1939). *Flora pentru determinarea şi descrierea plantelor ce cresc în România*. *Vol. II. Noţiuni generale de Fitogeografie*. *Fiziografia generală a României*. *Fitogeografia României*. 713 pag. Tipografia "Cartea Românească" Cluj.

Pyšek, P. (1995). On the terminology used in plant invasion studies. In: Pyšek, P., Prach, K., Rejmánek, M. and Wade, M. (eds.) *Plant Invasions: General Aspects and Special Problems*: 71-81. SPB Academic Publishing, Amsterdam.

Pyšek, P., Sádlo J., Mandák B. (2003). Alien flora of the Czech Republic, its composition, structure and history. *Plant Invasions: Ecological Threats and Management Solutions*: 113-130.

Pyšek P., Danihelka J., Sádlo J., Chrtek Jr. J., Chytrý M., Jarošík V., Kaplan Z., Krahulec F., Moravcová1 L., Pergl J., Štajerová K., Tichý L. (2012). Catalogue of alien plants of the Czech Republic (2nd edition): checklist update, taxonomic diversity and invasion patterns. *Preslia* 84: 155–255.

Răduţoiu D. (2011). Adventive species in the Danube between Calafat and Bechet (Oltenia, Romania). Muzeul Olteniei Craiova. Oltenia. *Studii şi comunicări. Ştiinţele Naturii*. Tom. 27, no. 1: 47-50.

Răduţoiu D., Stan I. (2013). Preliminary data on alien flora from Oltenia - Romania. *Acta Horti Bot. Bucurest*., 40: 33-42.

Sârbu, I., Ştefan, N., Oprea, A. (2013). *Plante vasculare din România, Determinator ilustrat de teren*. Edit. VictorBVictor, Bucureşti, 1317 pp.

Schmiedel, D., Pusch F., Elmer, M. (2014). Neophytes in restored postmining areas. Pages 153-153 in A. Uludag, Yazlik A., Jabran K., Turkseven S., Starfinger, U. (eds.). *Proceedings of the 8th International Conference on Biological Invasions*: *From Understanding to Action*, Antalya, Turkey.

Sîrbu, C. (2004). Segetal vegetation from Cotnari, Iaşi and Huşi vineyards. *Analele ştiinţifice ale Universităţii "A.I. Cuza", Tom I, s. II-a. Biologie vegetală*: 99-112.

Stevanovič, Z. D., Vrbničanin S., Jevdjovič, R. 2007. Weeding of cultivated chamomile in Serbia. *Acta Horticulturae* 749:149-155.

Velea, L., Bojariu, R., Burada, C., Udristioiu, M.T., Paraschivu, M., Burce, R.D. (2021). Characteristics of extreme temperatures relevant for agriculture in the near future (2021-2040) in Romania. *Scientific Papers. Series E. Land Reclamation, Earth Observation & Surveying, Environmental Engineering*. Vol. X: 70-75.

https://www.brc.ac.uk/plantatlas/plant/Veronica-polita; 18.02.2022, 12^{00}PM.

http://publish.plantnet-project.org/project/plantinvasivekruger/collection/collection/synthese/details/DIGSA; 23.02.2022, 17^{58}PM.