Current Trends in Natural Sciences Vol. 7, Issue 13, pp. 54-60, 2018

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

RUSSIAN OLIVE (ELAEAGNUS ANGUSTIFOLIA L.): A MULTIPURPOSE SPECIES WITH AN IMPORTANT ROLE IN LAND RECLAMATION

Cristian Mihai Enescu [1*]

[1] Department of Soil Sciences, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Boulevard, Bucharest-011464, Romania

Abstract
Elaeagnus angustifolia L. (Russian olive, oleaster) is generally regarded as a useful species across its distribution range. The aim of this review paper was to highlight the species' multiple uses, especially in forest land reclamation. Data regarding the taxonomy, chorology, ecological requirements and biological characteristics were also presented. Even if it is listed as an invasive species in many countries worldwide, Russian olive is one of the most common used species for improvement by afforestation of several categories of degraded terrains, especially the salt-affected and arid lands. It is also very appreciated in folk medicine, human and animal alimentation, cosmetics and landscape architecture. Due to its tendency to spread and colonize bare terrains or areas where it is not desired, a carefully monitoring of cultures with this species is more than necessary. In the perspective of contemporary climate change, characterized by higher temperatures and lower rainfall, Russian olive could gain more attention from foresters, ecologists and land managers who should develop an integrated management plan for this species.

Keywords: Elaeagnus angustifolia, land reclamation, oleaster, Russian olive.

1. INTRODUCTION

Genus *Elaeagnus* L. (2n=28) belongs to the family *Elaeagnaceae* and consists of approximately 70-80 species (Patel, 2015). The generic name of genus originates from the Greek *élaia*, which means olive, because the fruit looks like an olive (Bucur et al., 2005).

Elaeagnus angustifolia L. (Russian olive, oleaster) is a multiple-stemmed deciduous species of *Elaeagnus*, native to Eurasia. It was introduced in North America in the late 19th century for reclamation purposes or as a horticultural plant, but it has become invasive especially in riparian and other moist habitats (Schaffner et al., 2011; Collette and Pither, 2015), nowadays being reported to be an alien species also in New Mexico (Cox, 2001) and Argentina (Busso et al., 2013).

This species is usually a shrub or a small tree characterized by spiny thorns, silvery leaves and fruits, and a well-developed root system that makes it suitable for several categories of degraded terrains, as the ones affected by landslides or sheet erosion (Enescu, 2015). The vertical roots are capable of growing downwards to a depth of about 3.5 m (Feng et al., 2012). Across its wide distribution range, Russian olive is a component of several forest types, such as mixed *Populus-Elaeagnus* or *Tamarix-Elaeagnus* forests, *E. angustifolia*-dominated stands, and *Haloxylon* woodlands (Katz and Shafroth, 2003).

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

2. ECOLOGICAL REQUIREMENTS

Russian olive can tolerate a wide variety of environmental conditions (Pilinszky et al., 2015; Hamidpour et al., 2017). It is resistant to drought and frost (Stratu et al., 2016), withstanding temperatures ranging from - 45 to + 46 °C (Akbolat et al., 2008), with extreme fluctuation of diurnal temperature (Srivastava, 2010). *E. angustifolia* can grow in almost any type of soil (Aksoy and Şahin, 1999), even in soils affected by salinity (Katz and Shafroth, 2003), with different pH values (Doroftei et al., 2005). It grows best in deep sandy or loamy soils and it requires very low amount of precipitation per year (Akbolat et al., 2008).

3. BIOLOGICAL REQUIREMENTS

Russian olive has a rapid juvenile growth rate (Khamzina et al., 2009). It is an actinorhizal species that is forming nitrogen-fixing root nodules in symbiotic association with bacteria of the genus *Frankia* Brunchorst (Katz and Shafroth, 2003).

E. angustifolia can be propagated in both vegetative and generative ways, the seed dispersal being mainly done by water and animals (Busso et al., 2013). The flowering occurs in March-April, and the fruiting in September-October (Jabeen et al., 2015), the optimum fruiting being observed at the age of 40 (Baranov and Kositzyn, 2003). The vegetative propagation can also be done by micropropagation. It was reported that shoots were successfully obtained from nodal segments of mature trees (Iriondo et al., 1995). Like other invasive shrub species, Russian olive is able to resprout following fire (Harrod and Reichard, 2002).

4. RUSSIAN OLIVE: A MULTIPURPOSE SPECIES

Firstly, due to its ability to grow under a wide spectrum of soil conditions and to colonize bare lands, *E. angustifolia* represents one of the main choices for establishment of protective and productive forest plantations in many regions worldwide. It is one of the most commonly planted species in mixed shelterbelts in many countries, such as Ukraine (Sudnik-Wójcikowska et al., 2009), Turkey (Tolunay et al., 2007), Romania (Enescu, 2015), China (Missall et al., 2015) or United States of America (Zhou et al., 2007). In many cases, together with sea-buckthorn (*Hippophaë rhamnoides* L.) or *Populus* spp. (Heshmati, 2011; Missall et al., 2015), Russian olive was used in creating windbreaks orientated perpendicular to the prevailing wind direction (Strat, 2013; Enescu, 2014).

Secondly, Russian olive is regarded as an important medicinal plant worldwide (Tashev and Tsavkov, 2008; Uysal et al., 2010; Asl et al., 2012). Different plant extracts have shown to have antioxidant, antimicrobial, antimutagenic (Okmen and Turkcan, 2014; Hamidpour et al., 2017), antinociceptive, anti-inflammatory (Ahmadiani et al., 2000; Nikniaz et al., 2014), antipyretic and diuretic effects (Karaman and Kocabas, 2001). Also, this species has some other therapeutic properties which fight against many serious diseases, such as gastric pain, dysentery, jaundice and hepatitis A, B and C (Jabeen et al., 2015; Uzun et al., 2015). Moreover, the extract obtained from the fruits is used against dyspepsia (Khan et al., 2011), cough and cold (Afzal et al., 2009), in treatment of malignant fevers (Ajaib et al., 2014) or to improve osteoarhritis (Maghzi et al., 2015). The oil extracted from flowers is used in treatment of bronchial affections (Ajaib et al., 2014). Last but not least, fruit extracts proved to have significant muscle relaxant and antinociceptive effects in the case of mice (Hosseinzadeh et al., 2003; Karimi et al., 2010).

Thirdly, thanks to the fact that the fruits are rich in fructose, glucose, carbohydrates and vitamin C, they are consumes directly in many regions across its distribution (Ayaz et al., 1999; Ranjit et al., 2008; Özdemir and Kalyoncu, 2011; Ullah et al., 2014). The berries are also eaten by the Mountain

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Bluebird (*Sialia currucoides* Bechstein.) (Burnett and Fair, 2008) and the leaves have a superior fodder potential (Khamzina et al., 2006; Kumar, 2006; Djumaeva et al., 2009). The fruits may be used as seasoning in soups and can also be prepared into sherbets or jellies (Ajaib et al., 2014).
Fourthly, this species is very appreciated in landscape architecture (Christensen, 1963), being one of the most common urban trees, planted both in parks or street alignments (Guvensen et al., 2005; Corzo et al., 2009). In Turkey, it is used also for hiding bad views (Irmak and Yilmaz, 2008). Actually, its ornamental use played an important role in the artificially extending its distribution range, nowadays being quite common also in North America, for example.
Last but not least, *E. angustifolia* can have other less common utilizations. Its wood is used for fuel (Lamers and Khamzina, 2008; Jabeen et al., 2015) or for posts, beams and domestic items (Ajaib et al., 2014) or even timber (Khan et al., 2011). It is also a melliferous plant (Zima, 2007; Irimia et al., 2015; Yilmaz, 2016). The flower extracts may be used in perfumery (Bucur et al., 2009; Ajaib et al., 2014). The gum of this species is used as shampoo and as a tonic for long, healthy and shiny hairs (Khan et al., 2011; Jabeen et al., 2015). It plays also a significant role in carbon sequestration (Zhou et al., 2007).

5. THE ROLE OF RUSSIAN OLIVE IN LAND RECLAMATION

E. angustifolia is suitable for several categories of degraded lands, *i.e.* eroded soils, landslides, etc. (Gokturk et al., 2006), but in many cases it serves as a reforestation species of the salt-affected and/or sandy soils (Djumaeva et al., 2010; Heshmati, 2011; Lai et al., 2012; Dubovyk et al., 2014). Moreover, this species can grow in forest cultures installed also on alluvial soils (Negrea et al., 2013; Constandache and Nistor, 2014), or even on tailing dumps (Cântar et al., 2014) or mining dumps (Nețoiu et al., 2012).
It provided also good results in mixed plantations in steppe region, on highly eroded lands. For example, in Romania, at the age of 18 the average height of the young individuals was 2.9 m and the survival rate accounted for 84 % (Greavu and Mănescu, 2001).
Russian olive is also appreciated for its role in soil protection, producing large amounts of leaves, forming a thick litter that is rapidly decomposed. For example, in Uzbekistan, in the cultures installed on degraded, irrigated croplands, the leaf production of *E. angustifolia* was about 2.5 times higher compared with *Ulmus pumila* L. (Lamers et al., 2010).
Thanks to its well-developed root system, this species is able to pierce the very compact top soil (Roth, 1940), like in cases of the sites with lands affected by aridization (Qi and Cai, 2007).
Similar to sea-buckthorn (Enescu, 2014) and black locust (Enescu and Dănescu, 2013), two species often used in forest land reclamation worldwide, Russian olive has the ability to fix atmospheric nitrogen, so it enriches the soil in nutrients (Ajaib et al., 2014).

6. RUSSIAN OLIVE: RISKS AND DRAWBACKS

Russian olive meets the features for an invasive species, *i.e.* nitrogen fixation and rapid vegetative propagation (Daehler, 1998), and the biogeographic, spread and impact criteria described by Katz and Shafroth (2003). As a result, *E. angustifolia* is regarded as one of the most aggressive invasive plant worldwide. For example, in North America it was listed among the exotic invasive species with the potential to reduce local diversity (D'Antonio et al., 2004). The risk of local biodiversity loss is more pronounced in the cases when plantations containing Russian olive individuals are located within protected areas (Irimia et al., 2015).
In urban areas another risk can occur. It was reported that its pollen can generate allergic reaction to sensitive people (Sastre et al., 2004). Moreover, when it is introduced in the urban green areas, its

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

multiple-stemmed could play a double role. On one hand, this feature could limit the development of other desired species panted in its proximity, and, on the other hand, it could act as a veritable barrier that covers the bad views.

A shortcoming of Russian olive is represented by the lack of an efficient method for fruit collection. Usually, the harvesting is done manually. Due to the small dimensions of the fruits and to the presence of the thorns on twigs the quantities collected are small.

7. CONCLUSIONS

According to this brief review, Russian olive should be regarded more as a very useful multi-purpose tree species with a high potential for forest land reclamation, rather than a dangerous invasive one. Nevertheless, due to its tendency to spread and colonize bare terrains or areas where it is not desired, a carefully monitoring of cultures with this species is more than necessary in order to keep it under control or to prevent possible reduction of local diversity, especially in fragile sites.

In the perspective of contemporary climate change, characterized by higher temperatures and lower rainfall, Russian olive could gain more attention from foresters, ecologists and land managers who should develop an integrated management plan for this species.

8. REFERENCES

Afzal, S., Afzal, N., Awan, M.R., Khan, T.S., Gilani, A., Khanum, R., Tariq, S. (2009). Ethno-botanical studies from Northern Pakistan. *J Ayub Med Coll Abbottabad*, 21(1), 52-57.

Ahmadiani, A., Hosseiny, J., Semnanian, S., Javan, M., Saeedi, F., Kamalinejad, M., Saremi, S. (2000). Antinociceptive and anti-inflammatory effects of *Elaeagnus angustifolia* fruit extract. *Journal of Ethnoplarmacology*, 72(1-2), 287-292.

Ajaib, M., Haider, S.K., Zikrea, A., Siddiqui, M.F. (2014). Ethnobotanical studies of shrubs and trees of Agra Valley Parachinar, Upper Kurram Agency, Pakistan. *Fuuast J. Biol*, 4(1), 73-81.

Akbolat, D., Ertekin, C., Menges, H.O., Guzel, E., Ekinci, K. (2008). Physical and Nutritional Properties of Oleaster (*Elaeagnus angustifolia* L.) Growing in Turkey. *Asian Journal of Chemistry*, 20(3), 2358-2366.

Aksoy, A., Şahin, U. (1999). *Elaeagnus angustifolia* L. as a Biomonitor of Heavy Metal Pollution. *Tr. J. Of Botany*, 23, 83-87.

Asl, M.B., Talebpour, A.H., Alijanpour, R. (2012). Introducing of medicinal plants in Maragleh, Eastern Azerbaijan Province (Northwestern Iran). *Journal of Medicinal Plants Research*, 6(25), 4208-4220.

Ayaz, F.A., Kadioğlu, A., Doğru, A. (1999). Soluble Sugar Composition of *Elaeagnus angustifolia* L. var. *orientalis* (L.) Kuntze (Russian olive) Fruits. *Tr. J. Of Botany*, 23, 349-354.

Baranov, A.F., Kositzyn, V.N. (2003). Productivity and stocks of fruits of *Elaeagnus angustifolia* L. in basin of the Lower Volga. *Rastitel'nye Resursy*, 39(4), 54-60.

Bucur, L., Sava, C., Istudor, V. (2005). Contributions at the pharmacognostic study of *Elaeagnus angustifolia* L. species. Note I: Poliphenolic compounds study of fruits. *Contribuții Botanice*, XL, 247-252.

Bucur, L., Hîrjău, V., Istudor, V. (2009). *Elaeagnus angustifolia* L. flower soft extract valorification in a dermatological preparation. Note 2. Dermatological preparation rhelogic control. *Farmacia*, 57(3), 309-314.

Burnett, K.S., Fair, J.M. (2008). Winter diet of the mountain bluebird (*Sialia currucoides*) in Northern New Mexico. *NMOS Bulletin*, 36(4), 65-68.

Busso, C.A., Bentivegna, D.J., Fernández, O.A. (2013). A review on invasive plants in rangelands of Argentina. *Interciencia*, 38(2), 95-103.

Cântar, I.C., Borlea, G.F., Chisăliță, I. (2014). Research on amount and contents of litter on the plantation from the tailing dumps from Moldova Nouă. *Journal of Horticulture, Forestry and Biotechnology*, 18(2), 127-132.

Christensen, E.M. (1963). Naturalization of Russian olive (*Elaeagnus angustifolia* L.) in Utah. *The American Midland Naturalist*, 70(1), 133-137.

Collette, L.K.D., Pither, J. (2015). Modeling the potential North American distribution of Russian olive, an invader of riparian ecosystems. *Plant Ecology*, 216(10), 1-13.

Constandache, C., Nistor, S. (2014). Preventing and control of soil erosion on agricultural lands by antierosional shelter-belts. *Scientific Papers. Series E, Land Reclamation, Earth Observation & Surveying, Environmental Engineering*, 3, 29-36.

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Corzo, E.A., Garcia-Garcia, M.J., Saiz de Omenaca, J.A. (2009). Urban tree health of 49 green spaces in Madrid (Spain). *SDU Faculty of Forestry Journal*, Serial A, Special Issue, 219-232.

Cox, G.W. (2001). An Inventory and Analysis of the Alien Plant Flora of New Mexico. *The New Mexico Botanist*, 17, 1-8.

Daehler, C.C. (1998). The taxonomic distribution of invasive angiosperm plants: ecological insights and comparison to agricultural weeds. *Biological Conservation*, 84, 167-180.

D'Antonio, C.M., Berlow, E.L., Haubensak, K.L. (2004). Invasive Exotic Plant Species in Sierra Nevada Ecosystems, USDA Forest Service Gen. *Tech. Rep, PSW-GTR-193*, 175-184.

Djumaeva, D., Djanibekov, N., Vlek, P.L.G., Martius, C., Lamers, J.P.A. (2009). Options for Optimizing Dairy Feed Rations with Foliage of Trees Grown in the Irrigated Drylands of Central Asia. *Research Journal of Agriculture and Biological Sciences*, 5(5), 698-708.

Djumaeva, D., Lamers, J.P.A., Martius, C., Khamzina, A., Ibragimov, N., Vlek, P.L.G. (2010). Quantification of symbiotic nitrogen fixation by *Elaeagnus angustifolia* L. on salt-affected croplands using two ^{15}N isotopic methods. *Nutr Cycl Agroecosyst*, 88, 329-339.

Doroftei, M., Mierlă, M., Marinov, M. (2005). Ecology of some alien plant species in Danube Delta. *Ovidius University Annals of Natural Sciences, Biology – Ecology*, Series 9(1), 35-40.

Dubovyk, O., Menz, G., Khamzina, A. (2014). Land suitability assessment for afforestation with *Elaeagnus angustifolia* L. in degraded agricultural areas of the Lower Amurdarya River Basin. *Land Degradation & Development*, DOI: 10.1002/ldr.2329.

Enescu, C.M., Dănescu, A (2013). Black locust (*Robinia pseudoacacia* L.) – an invasive neophyte in the conventional land reclamation flora in Romania. *Bulletin of Transilvania University of Bra□ov, Series II: Forestry • Wood Industry • Agricultural Food Engineering*, 55(2), 23-30.

Enescu, C.M. (2014). Sea-buckthorn: a species with a variety of uses, especially in land reclamation. *Dendrobiology*, 72, 37-42.

Enescu, C.M. (2015). Shrub and tree species used for improvement by afforestation of degraded lands in Romania. *Forestry Ideas*, 21(1), 3-15.

Feng, Q., Peng, J.Z., Li, J.G., Xi, H.Y., Si, J.H. (2012). Using the concept of ecological groundwater level to evaluate shallow groundwater resources in hyperarid desert regions. *Journal of Arid Land*, 4(4), 378-389.

Gokturk, A., Olmez, Z., Temel, F. (2006). Some Native Plants for Erosion Control Efforts in Coruh River Valley, Artvin, Turkey. *Pakistan Journal of Biological Studies*, 9(4), 667-673.

Guvensen, A., Uysal, I., Celik, A., Ozturk, M. (2005). Analysis of airbone pollen fall in Canakhale, Turkey. *Pak. J. Bot*., 37(3), 507-518.

Greavu, M., Mănescu, M. (2001). Evolution of the stands growing on claimed lands in Dobrogea and tending works. *Analele ICAS*, 44(1), 100-105.

Hamidpour, R., Hamidpour, S., Hamidpour, M., Shahlari, M., Sohraby, M., Shahlari, N., Hamidpour, R. (2017). Russian olive (*Elaeagnus angustifolia* L.): From a variety of traditional medicinal applications to its novel roles as active antioxidant, anti-inflammatory, anti-mutagenic and analgesic agent. *Journal of Traditional and Complementary Medicine*, 7(1), 24-29.

Harrod, R.J., Reichard, S. (2002). Fire and invasive species within the temperate and boreal coniferous forests of Western North America. *Allen Press*, 95-101.

Heshmati, G.A. (2011). Biological Models for Protecting Different Land Use in Arid Areas China. *Journal of Rangeland Science*, 1(2), 235-246.

Hosseinzadeh, H., Ramezani, M., Namjo, N. (2003). Muscle relaxant activity of *Elaeagnus angustifolia* L. fruit seeds in mice. *Journal of Ethnopharmacology*, 84(2-3), 275-278.

Irimia, I., Ambroso, V., Stratu, A. (2015). Aspects regarding the anthropic influence on the "Movila lui Burcel" protected area (Vaslui County). *PESD*, 9(2), 159-172.

Iriondo, J.M., De La Iglesia, M., Pérez, C. (1995). Micropropagation of *Elaeagnus angustifolia* from mature trees. *Tree Physiology*, 15, 691-693.

Irmak, M.A., Yilmaz, H. (2008). Determination of the usability of woody plant species in Tortum – Creek Watershed for functional and aesthetical uses in the respect of landscape architecture. *Biological Diversity and Conservation*, 1(1), 1-12.

Jabeen, N., Ajaib, M., Siddiqui, M.F., Ulfat, M., Khan, B. (2015). A survey of ethnobotanically important plants of district Ghizer, Gilgit-Baltistan. *Fuuast J. Biol*., 5(1), 153-160.

Karaman, S., Kocabas, Y.Z. (2001). Traditional Medicinal Plants of K. Maras (Turkey). *The Sciences*, 1(3), 125-128.

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Karimi, G., Hosseinzadeh, H., Rassoulzadeh, M., Razavi, B.M., Taghiabadi, E. (2010). Antinociceptive Effect of *Elaeagnus angustifolia* Fruits on Sciatic Nerve Ligated Mice. *Iranian Journal of Basic Medical Sciences*, 13(3), 97-101.

Katz, G.L., Shafroth, P.B. (2003). Biology, ecology and management of *Elaeagnus angustifolia* L. (Russian olive) in Western North America. *WETLANDS*, 23(4), 763-777.

Khamzina, A., Lamers, J.P.A., Worbes, M., Botman, E., Vlek, P.L.G. (2006). Assessing the Potential of Trees for Afforestation of Degraded Landscapes in the Aral Sea Basin of Uzbekistan. *Agroforestry Systems*, 66(2), 129-141.

Khamzina, A., Lamers, J.P.A., Vlek, P.L.G. (2009). Nitrogen fixation by *Elaeagnus angustifolia* in the reclamation of degraded croplands of Central Asia. *Tree Physiology*, 1-10.

Khan, N., Ahmed, M., Ahmed, A., Shaukat, S.S., Wahab, M., Ajaib, M., Siddiqui, M.F., Nasir, M. (2011). Important medicinal plants of Chitral Gol National Park (CGNP) Pakistan. *Pak. J. Bot.*, 43(2), 797-809.

Kumar, B.M. (2006). Agroforestry: the new old paradigm for Asian food security. *Journal of Tropical Agriculture*, 44(1-2), 1-14.

Lai, L., Zhao, X., Jiang, L., Wang, Y., Luo, L., Zheng, Y., Chen, X., Rimmington, G.M. (2012). Soil Respiration in Different Agricultural and Natural Ecosystems in an Arid Region. *PLOS ONE*, 7(10), 1-9.

Lamers, J.P.A., Khamzina, A. (2008). Fuelwood production in the degraded agricultural areas of the Aral Sea Basin, Uzbekistan. *Boie et Forêts des Tropiques*, 297(3), 43-53.

Lamers, J.P.A., Martius, C., Khamzina, A., Matkarimova, M., Djumaeva, D., Eshchanov, R. (2010). Green foliage decomposition in tree plantations on degraded, irrigated croplands in Uzbekistan, Central Asia. *Nutr Cycl Agroecosyst*, 87, 249-260.

Maghzi, M., Khorsandi, L., Orazizadeh, M., Ahmadi, K. (2015). Histological effects of *Elaeagnus angustifolia* aqueous extract on cartilage degradation in experimental osteoarthritis. *Asian Journal of Phytomedicine and Clinical Research*, 3(2), 50-54.

Missall, S., Welp, M., Thevs, N., Abliz, A., Halik, U. (2015). Establishment and maintenance of regulating ecosystem services in a dryland area of central Asia, illustrated using the Kökyar Protection Forest, Aksu, NW China, as an example. *Earth System Dynamics*, 6, 359-373.

Negrea, B.M., Doroftei, M., Grimm, M., Roibu, C.C. (2013). Presence of alien ligneous species in some plant associations from Danube Delta and their management. *AACL Bioflux*, 6(2), 115-136.

Nețoiu, C., Hernea, C., Tomescu, R., Corneanu, M., Dragomir, P.I., Iovu, I., Cojoacă, F.D. (2012). The structural and auxological characteristics of the forest cultures installed on the mining dump Viaduct – Rovinari. *Annals of the University of Craiova – Agriculture, Montanology, Cadastre Series*, XLII(1), 427-437.

Nikniaz, Z., Ostadrahimi, A., Mahdavi, R., Ebrahimi, A., Nikniaz, L. (2014). Effects of *Elaeagnus angustifolia* L. supplementation on serum levels of inflammatory cytokines and matrix metalloproteinases in females with knee osteoarthritis. *Complementary Therapies in Medicine*, 22, 864-869.

Okmen, G., Turkcan, O. (2014). A study on antimicrobial, antioxidant and antimutagenic activities of *Elaeagnus angustifolia* L. leaves. *Afr J Tradit Complement Altern Med*., 11(1), 116-120.

Özdemir, G., Kalyoncu, I.H. (2011). A selection study on oleaster (*Elaeagnus angustifolia* L.) grown in the campus area of Selcuk University in Konya, Turkey. *African Journal of Biotechnology*, 10(77), 17726-17736.

Patel, S. (2015). Plant genus Elaeagnus: underutilized lycopene and linoleic acid reserve with permaculture potential. *Fruits*, 70(4), 191-199.

Pilinszky, K., Bittsanszky, A., Gyulai, G., Komives, T. (2015). Effects of ammonium salts on oleaster (*Elaeagnus angustifolia*). *Ecocycles*, 1(1), 27-32.

Qi, S., Cai, Y. (2007). Mapping and assessment of degraded land in the Heihe River Basin, arid northwestern China. *Sensors*, 7(11), 2565-2578.

Ranjit, S., Dwivedi, S.K., Ahmed, Z. (2008). Oleaster (*Elaeagnus angustifolia* L.): a less known multiple utility plant of cold arid high altitude region of India. *Plant Archives*, 8(1), 425-428.

Roth, G. (1940). A Magyar szikesek erdositeserol (On the afforestation of the Hungarian szik soils). *Erdeszeti Kiserletek*, 42, 225-252.

Sastre, J., Lluch-Bernal, M., Bustillo, A.M.G., Carnés, J., Maranón, F., Casanovas, M. (2004). Allergenicity and cross-reactivity of Russian olive pollen (*Elaeagnus angustifolia*). *European Journal of Allergy and Clinical Immunology*, 59(11), 1181-1186.

Schaffner, U., Zaquini, L., Cristofaro, M. (2011). Biological control of Russian olive, *Elaeagnus angustifolia*, Annual Report 2010, CABI Ref: VM10015 Issued April 2011, 17 p.

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Strat, D. (2013). Human induced alterations in plant biodiversity of Sărăturile Strand Plain – Delta Dunării. *Analele Universității din Oradea* – Seria Geografie, 2, 348-354.

Stratu, A., Costică, N., Costică, M. (2016). Wooden species in the urban green areas and their role in improving the quality of the environment. *PESD*, 10(2), 173-184.

Sudnik-Wójcikowska, B., Moysiyenko, I., Slim, P., Moraczewski, I. (2009). Impact of the invasive species *Elaeagnus angustifolia* L. on vegetation in Pontic desert steppe zone (Southern Ukraine). *Polish Journal of Ecology*, 57(2), 269-281.

Tashev, A.N., Tsavkov, E.I. (2008). Medicinal plants of the Bulgarian dendroflora. *Phytologia Balcanica*, 14(2), 269-278.

Tolunay, A., Alkan, H., Korkmaz, M., Bilgin, S. (2007). Classification of Traditional Agroforestry Practices in Turkey. *International Journal of Natural and Engineering Sciences*, 1(3), 41-48.

Ullah, A., Rashid, A., Parveen, S.N. (2014). Medicinal plants used in the isolated region of Bumburet, Kalash Valley, District Chitral, Pakistan. *Pak. J. Weed Sci*., Res. 20(3), 359-373.

Uysal, I., Onar, S., Karabacak, E., Çelik, S. (2010). Ethnobotanical aspects of Kapidağ Peninsula (Turkey). *Biological Diversity and Conservation*, 3(3), 15-22.

Uzun, A., Çelik, B., Karadeniz, T., Yilmaz, K.U., Altintaş, C. (2015). Assessment of fruit characteristics and genetic variation among naturally growing wild fruit *Elaeagnus angustifolia* accessions. *Turkish Journal of Agriculture and Forestry*, 39, 286-294.

Yilmaz, O. (2016). Traditional Honey Beekeeping in Turkey. *Journal of Animal and Veterinary Advances*, 6(10), 1317-1324.

Zhou, X., Brandle, J.R., Schoeneberger, M.M., Awada, T. (2007). Developing above-ground woody biomass aquations for open-grown, multi-stemmed tree species: Shelterbelt-grown Russian-olive. *Ecological Modeling*, 202, 311-323.

Zima, D. (2007). Contribution to the knowledge of honey-rich plants in Croatia. *Agronomski Glasnik*, 2, 147-160.

*Corresponding author, E-mail address: mihaienescu@agro-bucuresti.ro