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The *Pinus cembroides* tree as an alternative for reforesting cities, parks and gardens

El árbol *Pinus cembroides* como alternativa para reforestar ciudades, parques y jardines

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ABSTRACT

The pinyon pine (*Pinus cembroides*) is a Mexican endemic tree with potential use for reforesting cities, gardens and roadside medians due to its phenological characteristics. The objective of this research and review is to describe the general characteristics of pinyon pine trees in order to recognize their advantages when planted in urban areas. The information was obtained in orchards in situ and in the bibliographic search of databases. In the results, we found that the pinyon pine tree is an alternative for reforesting small, sunny spaces, it is green all the time with a growth of approximately 25 cm per year in its first years of life and has low water requirements. At 25 years of age it can reach 10 m in height, with a crown of 6 m in diameter, but it can be planted on the sidewalk and after 15 years of age it produces fruit. It concludes that the slow growth of the tree combined with its ecophysiological characteristics requires little maintenance and makes it attractive for use in cities, sidewalks and gardens.

Keywords: urban trees, pinyon pine, pinyon characteristics, slow growth

RESUMEN

El pino piñonero (*Pinus cembroides*) es un árbol endémico mexicano con uso potencial para reforestar ciudades, jardines y camellones carreteros debido a sus características fenológicas. El objetivo de la investigación y revisión es describir las generalidades de los árboles piñoneros para reconocer sus ventajas al sembrarlos en zonas urbanas. La información se obtuvo en huertas *in situ* y en la búsqueda bibliográfica de bases de datos. En los resultados encontramos que el árbol piñonero es una alternativa para reforestar espacios reducidos, soleados, es verde todo el tiempo con un crecimiento aproximado a 25 cm anuales sus primeros años de vida y tiene bajos requerimientos de agua. A los 25 años puede llegar a medir 10 m de altura, con una copa de 6 m de diámetro, pero se puede plantar en la banqueta y a partir de los 15 años produce frutos. Concluimos que el lento crecimiento del árbol combinado con sus características ecofisiológicas requiere poco mantenimiento y lo hace atractivo para usarse en ciudades, camellones y jardines.

Palabras clave: arbolado urbano, pino piñonero, características del piñón, crecimiento lento.

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INTRODUCTION

The total area of forests on the planet comprises 4,060 million hectares, corresponding to 31% of the world's surface; 45% of this amount is concentrated in the tropics and the rest is found in the boreal, temperate and subtropical regions (FAO, 2020). Regarding the plantation of forest hectares worldwide, 187 million hectares are cultivated, representing 4.8% of the total. According to FAO (2020), Mexico ranked third worldwide with forest areas designated to conserve biodiversity with 28,049 thousand hectares. However, a significant negative annual change in primary forest area was reported with approximately 250 thousand hectares per year.

Mexico has 40% of the species of the genus *Pinus*, known in the world due to the glaciations of the past; therefore, the Mexican territory served as a refuge for the Nearctic flora. Within this diversity, pinyon pines were concentrated in the Mexican highlands, but with subsequent climatic modifications there was greater competition between species; thus the distribution of pinyon pines was restricted to the foothills (Granados *et al*., 2015).

Pinyon pine (*Pinus cembroides*) is a species native to Mexico, distributed in 19 states; with higher incidence in: Chihuahua, Durando, Coahuila, Nuevo León, Tamaulipas, Veracruz, San Luis Potosí, Aguascalientes, Querétaro, Hidalgo, Zacatecas and Guanajuato; it grows in places with precipitation of 350 to 700 mm; in addition, this species is considered a priority for the National Commission for the Knowledge and Use of Biodiversity (Figure 1. A and B) (Constante *et al*., 2009; García-Aranda *et al*., 2018; Fuentes-Amaro *et al*., 2019).

In Guanajuato state it is naturally distributed in the north in Sierras de Jacales, San Pedro, Santa Bárbara y del Cubo, in Cuchilla, Águila and Zamorano hills (Ozuna *et al*., 2016; Fuentes-Amaro *et al*., 2019). As noted by Gutiérrez-García *et al*. (2015) altitude may be a limiting factor for the distribution of the species, because it prefers altitudes higher than 1,350 m a.s.l; but specimens can be found up to 2,800 m a.s.l. *P. cembroides* inhabits semiarid zones in Mexico and because of its ecological relevance it is considered for use in reforestations, ecological restoration projects and even in urban tree plantations; it is also mentioned that due to the constant loss of surface area, tree species have been sought to recover degraded soil surfaces and these authors made a list of useful species including *P. cembroides* (Figure 1. C and D). In addition, Constante *et al*. (2009) state that pinyon trees withstand long periods of drought, in their dendrological studies recorded in their research from 1784 to the year prior to their publication.

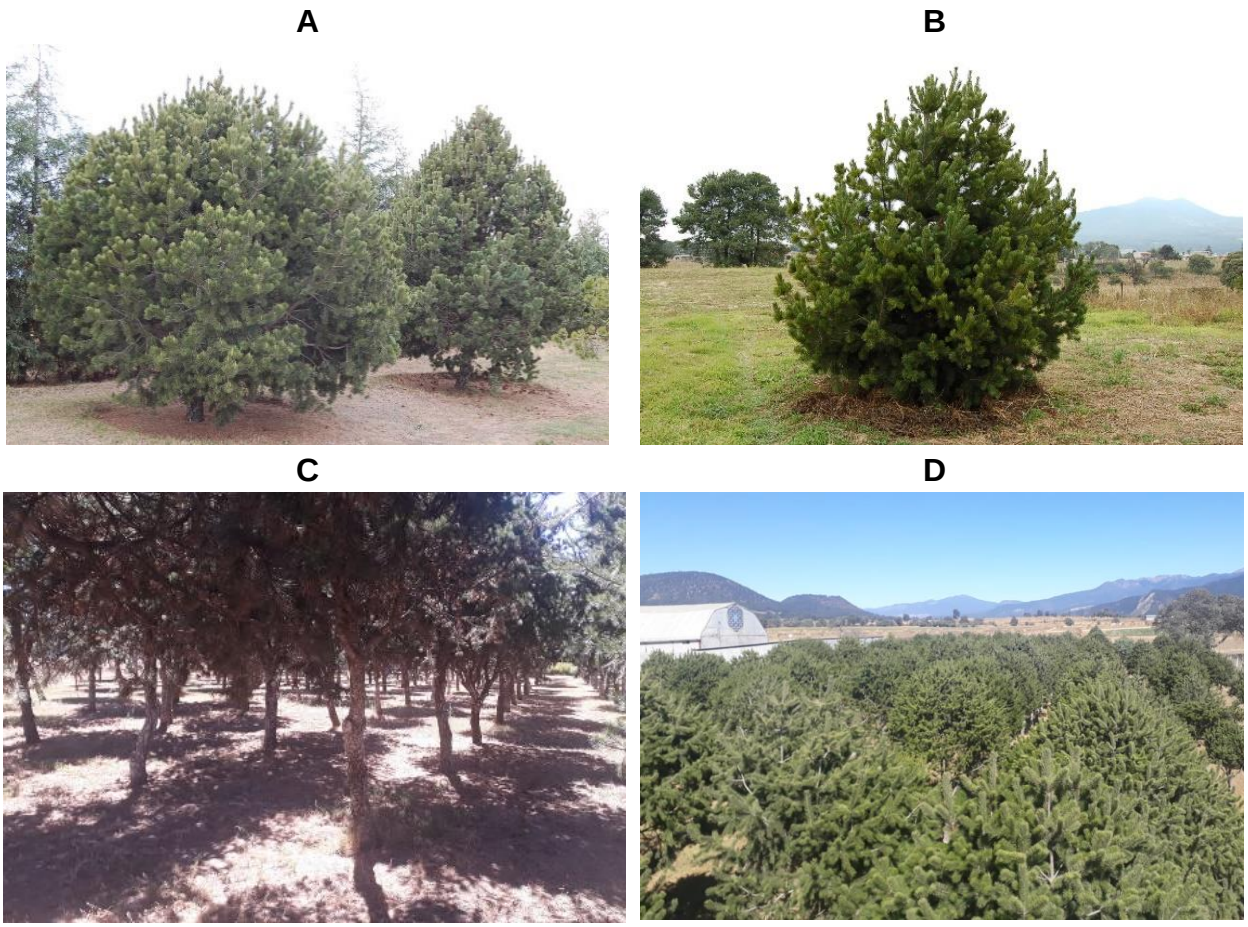

Figure 1. A and B. Twelve-year-old pinyon trees, 5 m tall, planted at 2,500 m a.s.l. in Ayapango. C and D. 20-year-old trees in a small pinyon orchard in San Cristobal Poxtla, Ayapango, State of Mexico, Mexico

Currently there are potential spaces in cities and public gardens for planting trees, with the objective of enriching the architecture of the environment. An alternative proposed is the use of *P. cembroides*, because of its slow growth, low maintenance cost and ecophysiological characteristics; it can be an alternative for urban tree planting. Therefore, the objective of the research is to describe the stone pine as an alternative to improve the landscape of cities and gardens, reducing maintenance costs and water consumption.

SIZE AND LONGEVITY

The pinyon pine is a tree that remains green all year round and can reach 5 m in height at 20 years of age and 8 to 10 m at 25 years of age. National Center for Disciplinary Research in Conservation and Improvement of Forest Ecosystems (Centro Nacional de Investigación Disciplinaria en Conservación y Mejoramiento de Ecosistemas Forestales) mentions that the tree can reach 15 m in height, but does not indicate the age and there are no field records (Flores et al., 2011). The diameter at 20 years of age is 65 ± 8 cm (Figure 1. C and D). In Chihuahua and Durango states, trees have been found that are

approximately 300 years old; it is considered a slow-growing species that hardly exceeds 25 cm in the first years of life, which becomes a great advantage for reduced spaces. Alva-Rodríguez *et al.* (2020) state that drought influences the growth of *P. cembroides*; good irrigation (38-45% humidity) generated trees with 20.58 cm in height with 5.89 cm in diameter and trees that suffered drought (30-36% humidity) presented 13.86 cm in height with 3.26 cm in diameter.

González-Ávalos *et al*. (2006) report that 15-year-old trees presented an average of 3 cones, at 16 years of age 9 cones and at 16 years of age up to 17 cones; however, it is mentioned that within a plantation there is the possibility of having early trees that can be selected for early production of pine nuts; it is also emphasized that cone production depends on environmental conditions.

HABITAT

The pinyon tree grows on mountain slopes, hillsides, hills with dry and rocky slopes, as well as preferring semi-warm dry climates (BS_0h) and the least dry of the dry climates (BS_1 kw), temperate with warm summer (BS_1h) and in the driest of the sub-humid climates (Cw_0). The most interesting thing about *Pinus cembroides* is its drought tolerance, it withstands up to eight months; it grows in poor, dry, stony, limestone and calcareous, but well-drained soils; it tolerates soils with acid or basic pH (Constante *et al*., 2009; Granados *et al*., 2015). It adapts to soils with a pH of 4 to 8, to climates with temperatures ranging from 7 to 30ºC with an annual average of 18ºC, minimum temperatures of -7ºC and maximum temperatures of 42ºC. Within natural environments the pinyon tree is abundant in the arboreal stratum and can host a good number of plant and non-plant species (Chavoya *et al.,* 2016). Constante *et al*. (2009), report that the pinyon tree withstands droughts of great magnitude reported in central and northern Mexico.

García-Arana *et al*. (2018) conducted a study on the potential distribution of the three pinyon tree species with the 22 bioclimatic variables for modeling; their results showed that *P. cembroides* adapts to environments with temperatures from 17 to 20°C and precipitation between 200 and 400 mm annually (bioclimatic variable 5: maximum temperature of the hottest month and bioclimatic variable 9: maximum temperature of the driest quarter). According to data reported by CONAGUA (2020), the rainfall in 11 states of the country and their average annual temperature in the 11 states indicated, have the ideal general characteristics for growing stone pine with good chances of success (Table 1).

USES

The main use of this species is food, due to the pine nut consumption, which generates economic income (García-Arana *et al*., 2018; Ozuna *et al*., 2016). On the other hand, it is a suitable species for reforesting eroded arid areas; likewise, it is a recommended tree for decorating parks, gardens, sports fields and medians; it can even be used as a Christmas tree (Figure 2). Its limited annual height increase is an advantage when planted in cities,

as it avoids periodic maintenance pruning, and its low water requirements give it the rusticity to increase survival over the years.

Table 1. Average annual precipitation (mm) and temperature (Cº) of Mexican entities that can grow *Pinus cembroides*

Municipality	Precipitation	Temperature
Aguascalientes	498.1	18.1
Coahuila	227.2	22.3
Chihuahua	260.8	19.2
Ciudad de México	469.7	18.3
Durando	390.4	18.6
Guanajuato	475.5	19.5
Hidalgo	501.5	19.3
Querétaro	407.0	20.5
San Luis Potosí	446.3	24.4
Sonora	343.0	23.4
Zacatecas	406.3	18.3

(CONAGUA, 2020)

Its wood is not of high quality and is used for forestry, but it can mitigate the impact of CO_2 in cities (Pompa-García & Yerena-Yamalliel, 2014); in this sense, Ozuna *et al*. (2016) point out that due to the limited use of wood, the piñon forests are well conserved. Álvarez *et al*. (2009) mention that Christmas trees include the following species: *Abies religiosa*, *Pseudotzuga menziesii*, *Picea* sp., *Cupresus lindleyii*, *P. ayacahuite*, *P. greggi* and *P. cembroides*.

SEED

The green seeds in trees are integrated in pine cones of different sizes, which can range from a couple of pine cones up to 30 units, they can be found alone or in groups of three to five pine cones (Figure 3. A, B, C and D). For an adequate selection and harvesting of seeds, they should be obtained at the time when they begin to open in October for the Mexican highlands. These pine cones are collected manually and placed in the shade until they are dry for opening and release of the pine nuts (Figure 3. E and F).

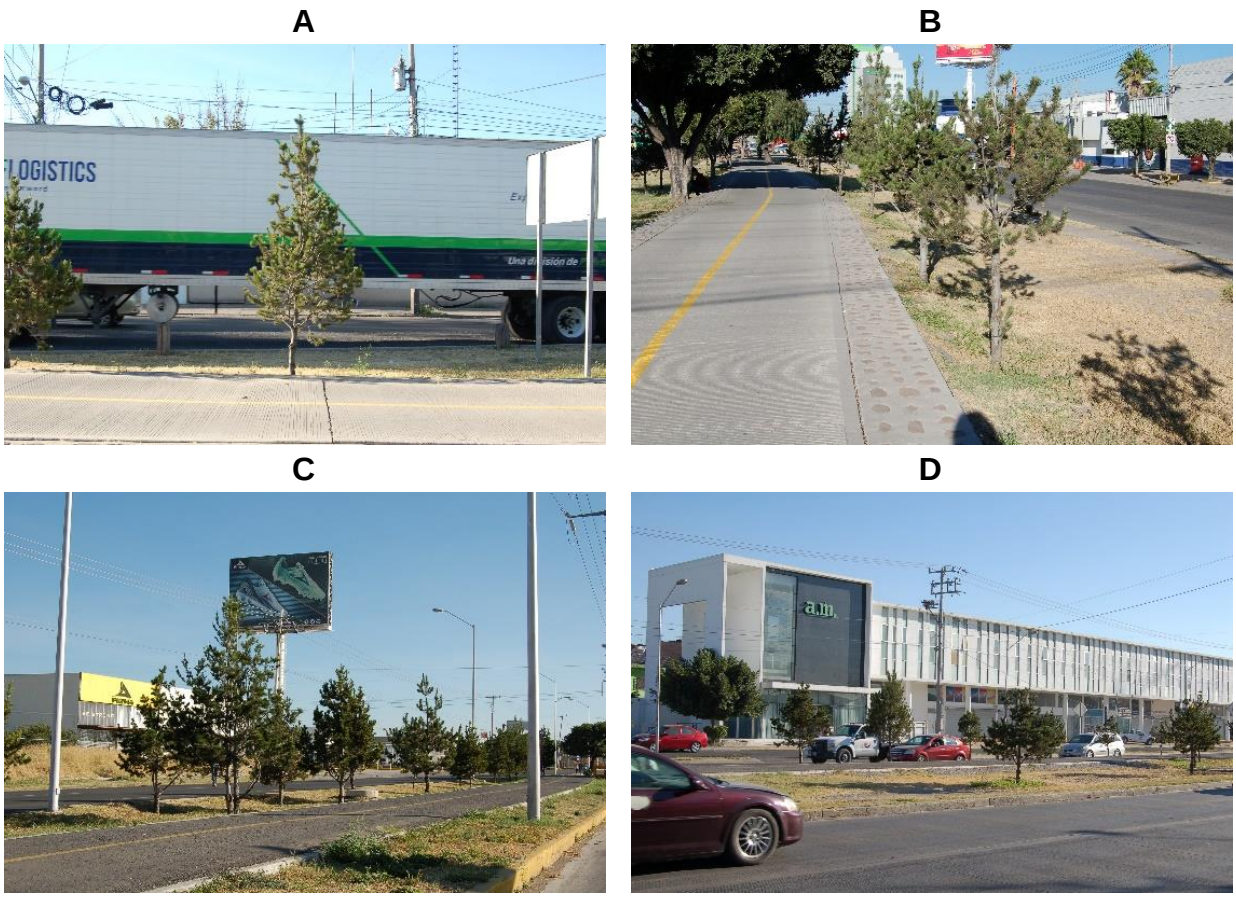

Figure 2. A and B. pinyon trees approximately 12 years old, 3 m high at 1,760 m a.s.l. planted in Av. México Japón. C and D. Eje Norponiente Avenue, Celaya, Guanajuato, Mexico.

The fruit of the pinyon pine comes from the female cones known as pine cones, and it is valued for its flavor and nutritional properties. It is used as an ingredient in sweets, desserts and salads; it has 31% protein, antioxidant compounds, fatty acids, vitamin B1, potassium and phosphorus (Flores *et al*., 2011; Ozuna *et al*., 2016). Internationally it is marketed as a dried fruit, the most expensive in the world; for such reason it has earned the over name of the Diamond of dried fruits in countries such as Chile, Spain, Turkey or Portugal.

The seed is oval of variable size and the amount that an unselected kg can contain can range from 3,110 to 5,000 seeds (Flores *et al*., 2011). For their part González-Ávalos *et al*. (2006) report that as the years of life of trees increase the tendency is an increase in the amount of seeds; in this report they point out that after 5 years the number of seeds per cone can increase up to 8; the kg of large seed can have 1,500 units, but they can be grouped into four types of seed according to their length of: 14.44, 13.49, 12.63 and 12.11 millimeters (Figure 3).

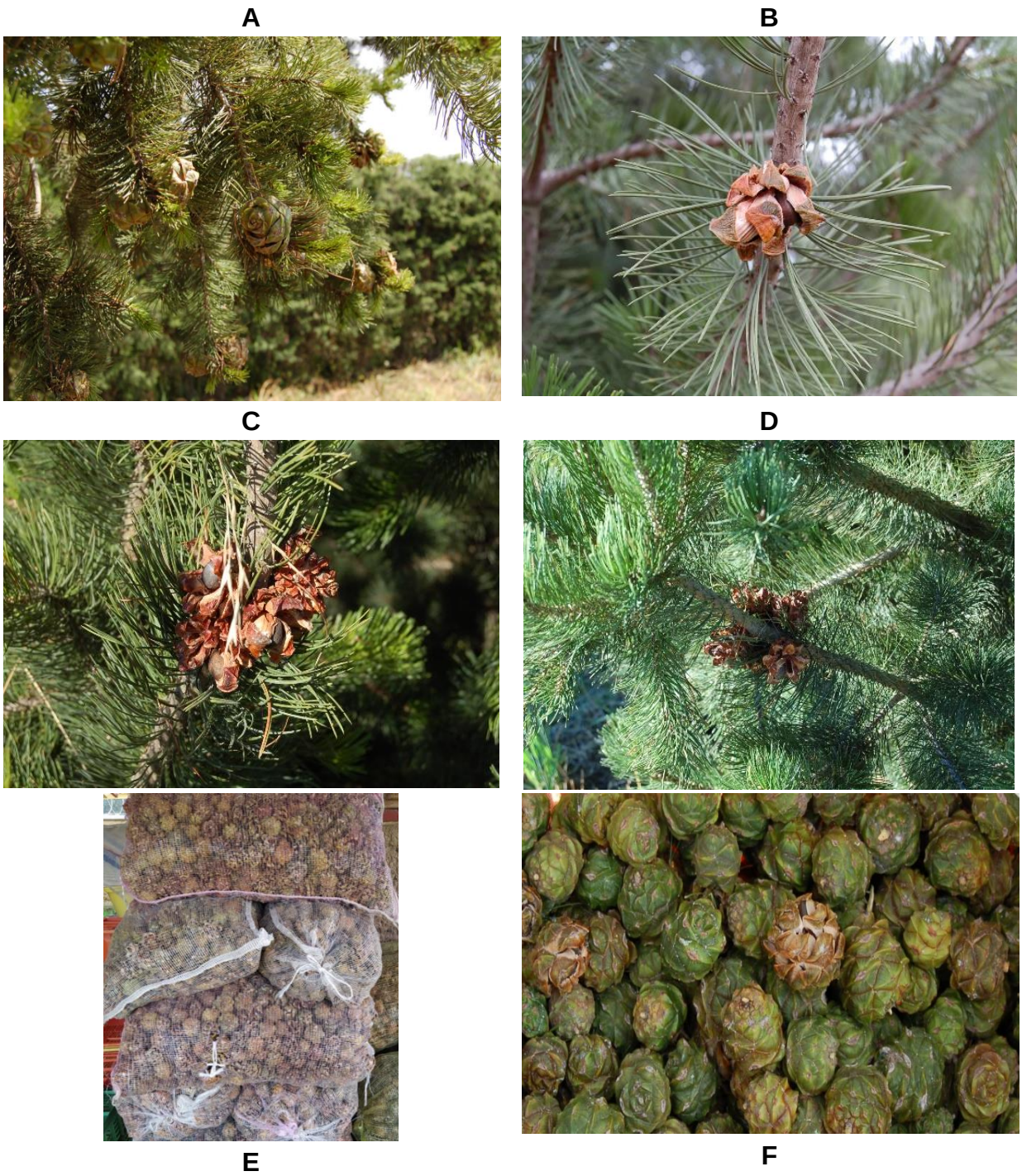

Figure 3. Green seeds in the trees are integrated in pine cones of different sizes, which can range from a couple of pine cones to about 30 units, as shown in image A, B, C and D. E and F. Pine cones collected under shade to dry for opening.

URBAN TREES

Urban woodland encompasses all vegetation found within cities, this space is constituted by green belts, parks, trees on sidewalks, cemeteries and urban forests; although rivers and lakes found within or near an urban area are also considered (Gómez-Baggethunam & Bartonc, 2013; Leal *et al*., 2018).

Among the benefits of urban trees are the generation of ecosystem services, such as shade by intercepting solar radiation, soil retention, rainwater interception, air filtration and suspended particle sinks, which support the reduction of climate change. In terms of economic benefits, they increase the value of real estate, amortize noise, and enhance buildings and monuments.

In addition, trees conserve biodiversity because they harbor insects, plants, and microorganisms; they also provide aesthetic benefit due to the shapes, colors, and distribution of the vegetation cover; it should be mentioned that the services of evergreen trees are better compared to deciduous trees Ponce & Piedrahita, 2009). Endreny, (2018) reported that several megacities, including Mexico City, produced benefits from the presence of urban trees of 505 million to 7.9 billion pesos for storing carbon emissions.

In the selection of urban trees, maintenance, loss estimation, life expectancy, aesthetic value, location, shape, cost, depreciation and quantification of municipal expenses must be considered. The valuation of trees applies to individual species or groups, but not to forest crops (Ponce & Piedrihita, 2009). Currently, there are formulas to quantify the cost of trees; however, they are based on the initial value of the tree, annual maintenance, age, annual interest rate, trunk area, location, among other variables (Ponce-Donoso *et al*., 2013). On the other hand, costs have been quantified for environmental services, such as air purification, urban cooling and climate regulation (Gómez-Baggethunam & Bartonc, 2013).

In the case of urban tree maintenance, it is an activity that should not be left aside; in the case of the stone pine, it requires little maintenance, because it is a pruning species due to its slow growth characteristic of the species, together with the environmental conditions, especially the amount of water, which can be a limiting factor for its good establishment (Gómez-Baggethun & Barton 2013; López & Benavides, 2014). For this reason, the use of species that can adapt to the conditions of the site is an important element in the selection.

In order to reforest urban spaces, the selection of the tree species must be taken into account, which can lead to a loss of trees due to unsuitable conditions such as temperature, insolation, precipitation, atmospheric pollution and even the physical space available. Pinyon pine has been used in preliminary reforestation programs due to its

genetic and environmental plasticity; this makes it an attractive species for use in degraded areas. Ríos *et al*. (2008) carried out a study in which measurements were taken on *P. cembroides, P. nelsonii and P. pinceana* at the age of 19 years. Their results showed that the trees had a height of 3.5-5.0 m and a basal diameter of 6-7 cm; this record indicates the slow growth of the pinyon tree and because of this characteristic it can be used in places with the aforementioned climates, ensuring its establishment and survival.

The longevity of the pinyon pine has been demonstrated by dendrological studies, they are long-lived trees that can reach 400 years, they occupy different climatic conditions and these trees have been found in Coahuila, Durango, Tlaxcala, Nuevo León and Guanajuato (Villanueva *et al.*, 2010; Herrera-Soto *et al*., 2018). There is information regarding the use of urban trees in Mexico, but the information is scattered and depending on the area of the country are the recommendations generated; for example, according to the book of "Wild Plants in the Urban Landscape of León Municipality, Guanajuato".(Plantas Silvestres en el Paisaje Urbano del Municipio de León, Guanajuato), they point out a classification of trees based on their height where *P. cembroides* is found within the 32 species distributed in 16 botanical families for tall trees (Elizondo *et al*., 2018). These authors point out that the tree can be developed in planter or landscaping, in reduced space such as bicycle path, median or pedestrian paths (Terrones *et al.*, 2014).

CONCLUSIONS

The Mexican pinyon is a suitable tree for reforesting urban areas, because it remains green all year round, is slow growing and needs little water. It can be planted in limited and sunny spaces in cities, gardens, or sidewalks, due to the limited maintenance required; it can establish in various types of soils as it withstands pH conditions. This tree generates green spaces tolerant to semi-desert conditions and thus: protects the soil, generates a microclimate, reduces noise, increases the value of the areas where it is located and generates recreational spaces for the population.

CITED LITERATURE

ÁLVAREZ JG, Colinas MT, Sahagún J, Peña A, Rodríguez JL. 2009. Tratamientos de poscosecha en árboles de navidad de *Pinus ayacahuite* Ehrn. y *Pseudotsuga menziesii* (Mirb.) Franco. *Revista Ciencia Forestal en México*. 34(106):171-190. ISSN 1405-3586. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-35862009000200009

ALVA-RODRÍGUEZ S, J López-Upton, Vargas-Hernández J, del Mar Ruiz-Posadas L. 2020. Biomass and growth of *Pinus cembroides* Zucc and *Pinus orizabensis* DK Bailey & Hawksworth in response to water deficit. *Revista Chapingo Serie Ciencias Forestales*. 26(1). https://doi.org/10.5154/r.rchscfa.2019.02.015

CHAVOYA RM, Granados SD, Granados VRL, Esparza GS. 2016. Clasificación y ordenación de bosques de pino piñonero del estado de Querétaro. *Revista Mexicana de Ciencias Forestales.* 7(33):52-73. https://doi.org/10.29298/rmcf.v7i33.90

CONAGUA (Comisión Nacional del Agua). 2020. Precipitación (mm) por entidad federativa y nacional.
https://smn.conagua.gob.mx/tools/DATA/Climatología/Pronóstico%20climático/Temperatura%20y%20lluvia/PREC/2020.pdf

CONSTANTE GV, Villanueva DJ, Cerano PJ, Cornejo OEH, Valencia MS. 2009. Dendrocronología de *Pinus cembroides* Zucc. y reconstrucción de precipitación estacional para el Sureste de Coahuila. *Ciencia forestal en México*. 34(106):17-39. ISSN: 2007-1132.
https://cienciasforestales.inifap.gob.mx/editorial/index.php/forestales/article/view/685

DONOSO MP, Piedrahita P. 2009. Valoración económica del arbolado urbano en 28 comunas de Chile. *Quebracho-Revista de Ciencias Forestales*. 17(1-2):88-100. ISSN: 0328-0543. https://www.redalyc.org/pdf/481/48113035009.pdf

ELIZONDO CEL, Elizondo NL, Rodríguez EA, Ledezma MAP, Olivo AM, Rodríguez EB. 2018. Estructura, composición y diversidad del arbolado urbano de Linares, Nuevo León. *Revista Mexicana de Ciencias Forestales*. 9(48):252-270. https://doi.org/10.29298 /rm cf. v8i48.129

ENDRENY TA. 2018. Strategically growing the urban forest will improve our world. *Nature communications*. 9(1):1-3. https://doi.org/10.1038/s41467-018-03622-0

FAO (Organización de las Naciones Unidas para la Alimentación y Agricultura). 2020. Evaluación de los recursos forestales mundiales 2020 – Principales resultados. Roma. https://doi.org/10.4060/ca8753es

FLORES GA, Pineda OT, Prieto RJA, Velásquez VMA, Muñoz VJA, Macías RH, Cueto WJA. 2011. Producción de planta en vivero para el estado de Tlaxcala. Folleto Técnico Núm. 6. CENID-COMEF, INIFAP. México, D.F. México. Pp. 64. ISBN: 978-607-425-699-4. https://www.researchgate.net/publication/325579036_Produccion_de_planta_en_vivero_para_el_estado_de_Tlaxcala

FUENTES-AMARO SL, Legaria-Solano JP, Ramírez-Herrera C. 2019. Estructura genética de poblaciones de *Pinus cembroides* de la región central de México. *Revista Fitotecnia Mexicana*. 42(1): 57-65. https://doi.org/10.35196/rfm.2019.1.57-65

GARCÍA-ARANDA MA, Méndez-González J, Hernández-Arizmendi JY. 2018. Distribución potencial de *Pinus cembroides*, *Pinus nelsonii* y *Pinus culminicola* en el Noreste de México. *Ecosistemas y recursos agropecuarios*. 5(13):3-13. https://doi.org/10.19136/era.a5n13.1396

GÓMEZ-BAGGETHUN E, Barton DN. 2013. Classifying and valuing ecosystem services for urban planning. *Ecological Economics*. 86: 235-245. https://doi.org/10.1016/j.ecolecon.2012.08.019

GONZÁLEZ-ÁVALOS J, García-Moya E, Vargas-Hernández JJ, Trinidad-Santos A, Romero-Manzanares A, Cetina-Alcalá VM. 2006. Evaluación de la producción y análisis de conos y semillas de *Pinus cembroides* Zucc. *Revista Chapingo. Serie Ciencias Forestales y del Ambiente.* 12(2): 133-138. ISSN: 2007-3828. https://www.redalyc.org/pdf/629/62912206.pdf

GRANADOS VRL, Granados SD, Sánchez-González A. 2015. Caracterización y ordenación de los bosques de pino piñonero (- subsp. orizabensis) de la Cuenca Oriental (Puebla, Tlaxcala y Veracruz). *Madera y bosques*. 21(2): 23-43. Versión On-line ISSN 2448-7597. https://doi.org/10.21829/myb.2015.212443

GUTIÉRREZ-GARCÍA JV, Rodríguez-Trejo DA, Villanueva-Morales A, García-Díaz S, Romo-Lozano JL. 2015. Calidad del agua en la producción de *Pinus cembroides* Zucc. en vivero. *Agrociencia*. 49(2): 205-219**.** *Version On-line* ISSN 2521-9766. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-31952015000200008

HERRERA-SOTO G, González-Cásares M, Pompa-García M, Camarero JJ, Solís-Moreno R. 2018. Growth of *Pinus cembroides* Zucc. in response to hydroclimatic variability in four sites forming the species latitudinal and longitudinal distribution limits. *Forests.* 9(7): 440. https://doi.org/10.3390/f9070440

LEAL E, Leal EN, Alanís RE, Pequeño LMÁ, Mora-Olivo A, Buendía RE. 2018. Estructura, composición y diversidad del arbolado urbano de Linares, Nuevo León. *Revista Mexicana de Ciencias Forestales*. 9(48): 252-270. https://doi.org/10.29298/rmcf.v8i48.129

LÓPEZ LSF, Benavides MHM. 2014. Ensayo de seis especies arbóreas para la reforestación de la segunda sección del Bosque de Chapultepec. *Revista Mexicana de Ciencias Forestales.* 5(21): 24-39. https://doi.org/10.29298/rmcf.v5i21.356

OZUNA C, García AC, Salazar JAG, Solís ES, Morales MES, Juárez MDRA. 2016. Potencial de productos alimenticios originarios de la zona noreste de Guanajuato. *Acta Universitaria.* 26(2): 83-92. https://doi.org/10.15174/au.2016.1529

POMPA-GARCÍA M, Yerena-Yamalliel JI. 2014. Concentración de carbono en *Pinus cembroides* Zucc: fuente potencial de mitigación del calentamiento global. *Revista Chapingo. Serie Ciencias Forestales y del Ambiente*. 20(3): 169-175. https://doi.org/10.5154/r.rchscfa.2014.04.014

PONCE-DONOSO M, Vallejos-Barra Ó, Daniluk-Mosquera G, Avilés-Palacios C. 2013. Comparación de siete fórmulas chilenas para la valoración del arbolado urbano. *Agrociencia*. 47(7):723-737. *Versión On-line* ISSN 2521-9766 http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-31952013000700008

PONCE PM, Piedrahita P. 2009. Valoración económica del arbolado urbano en 28 comunas de Chile. *Revista de Ciencias Forestales*. 17:1-2. ISSN: 0328-0543 https://www.redalyc.org/pdf/481/48113035009.pdf

RÍOS CEDL, De Hoogh R, Návar CJJ. 2008. Ensayos de especies con pinos piñoneros en el nordeste de México. *Revista Chapingo. Serie Ciencias Forestales y del Ambiente*. 14(2): 97-104. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2007-40182008000200004

TERRONES RT, Partida Pizzini FV, González SC, Tovar HM. 2014. Plantas Silvestres en el Paisaje Urbano del Municipio de León, Gto. *Publicación Técnica del Instituto Municipal de Planeación (IMPLAN)*. Municipio de León, México. Pp. 211. https://www.leon.gob.mx/leon/medioambiente/articulo.php?a=37

VILLANUEVA DJ, Cerano PJ, Stahle DW, Constante GV, Vázquez SL, Estrada AJ, Benavides SJDD. 2010. Árboles longevos de México. *Revista Mexicana de Ciencias Forestales*.1(2): 7-30. https://doi.org/10.29298/rmcf.v1i2.634