# THE RADIOGRAPH OF AN INVASIVE SPECIES (*ULMUS PUMILA*)

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**Abstract.** *Ulmus pumila* is a woody species appreciated for some purposes but problematic due to its invasive character. Because of its qualities, siberian elm is now used in landscaping design and as well in hybridization proceses. This article summarizes the advantages and disadvantages of siberian elm, based on the results obtained by scientific researchers. Based on the morphological characteristics, ecological requirements and achievements in scientific research made on the field of *Ulmus pumila*, conclusions were drawn regarding the possibilities of using this species in landscaping design.

**Keywords:** siberian elm, performances, colonizing species, adaptability, efficency

## INTRODUCTION

*Ulmus pumila* is a deciduous small to medium sized tree, or often it appears as a shrub or bush. The dark green leaves have oblique base and a serrated margin and they turn to yellow on autum. The flowering occurs in early spring, before the appearance of the leaves, just like on other elm species. Siberian elm is able for a succesfully self-pollination from wich results fruits called samaras (Zaharia, 1998). *Ulmus pumila* is highly tolerant of Dutch elm disease (DED) and has been used as a source of disease resistance genes in many elm breeding programs (Smalley and Guries 1993).

In U.S., *Ulmus pumila* is considered an invasive tree (USDA, NRCS 2002; Ding et al. 2006; Zalapa et al. 2009). It is native to East Asia and it was introduced into the United States in the early 1900s (Ware, 1995). It was probably introduced into Spain in the 16th century, and from the 1930s into Italy to replace dying elms (Cogolludo-Agustín et al., 2000). Siberian elm is of the one of the most problematic woody species (Zalapa et al. 2009) having naturalized or invasive populations finded in Canada, Mexico, Argentina or Spain (Cogolludo-Agustin et al., 2000).

Even it is an invasive species, it can have significant impacts on human health and human economic, cultural and ecological well being (Mack et al., 2000; Pimentel, 2002; Colautti et al., 2006; Pfeiffer and Voeks, 2008). Therefore, researchers showd that *Ulmus pumila* has high restoration ability for chloride and for fluoride (Lu et al., 2010), or even a high absorption capacity to heavy metals like Pb or Cd (Lu et al., 2003 ). Also, Elms are often used on the Great Plains, to serve as windbreaks and shelterbelts (Webb, 1948; Ward, 1985). These plants have been used for thousands of years since early farmers found them in ancient forests and transplanted near their homesteads. Until Dutch elm disease arrived in the 1930s, elms were used as a landscape trees throughout temperate North America (Thakur and Karnosky, 2010).

Invasive and colonizing species have been observed and studyed for decades (Baker and Stebbins, 1965; Cox, 2004), especially concerning the role of natural selection in the adaptation of species to new environments (Allendorf and Lundquist, 2003; Blair and Wolfe, 2004; Holt et al., 2005).

*Ulmus pumila* L. (*Ulmaceae*) has good performances of fast growth, strong adaptability and resistance, and high economy value, being used also as a forestation species of shelter forest and saline alkali land in recent years, especially in the semi-arid sand land (Shi et al., 2004). The species has a high sunlight requirement and is not shade-tolerant; with adequate light it exhibits rapid growth.

The tree is also fairly intolerant of wet ground conditions, growing better on well-drained soils (http://en.wikipedia.org/wiki/Ulmus_pumila#cite_note-15). The species proved good result on gas exchange, biomass allocation, preventions of insect pest and disease (Solla et al., 2005; Wang and Wang, 2005; Qu et al., 1999), or techniques for raising seedling (Zhang et al., 2003) of *U. pumila*. By using *U. pumila* leaves exposed to salt stress, researchers proved the permeability and relative antioxidant enzymes activities of protection system in cell plasma membrane and axplained the adaptive responses of plant cells under environmental stresses (Song et al., 2006).

*U. pumila* trees have both very deep tap roots and far-reaching lateral roots (Li et al., 2002), and often co-exist with grasses and forbs with shallow rooting depth (Jin et al., 2009). Many studies have demonstrated that under arid climate, trees or shrubs play active roles for sustaining the activities of shallow-rooted plants and associated microbial communities through naturally occurring hydraulic redistribution (Querejeta et al., 2007). *Ulmus pumila* has proved to be tolerant to partial sand burial, but must be protected from complete burial (Shi et al., 2004). Studyes showed that this species possess the ability of hydraulic redistribution and reversed water-flow could occur in lateral roots. This might be a partial explanation for greater soil respiration under the canopy field than in the open field developed (Jin et al, 2009). Some trees and shrubs were tested as possible windbreaks during 1963-1967 at more sites in Kansas and the results show that the most effective shrub was *Tamarix* and the most effective tree Siberian elm (*Ulmus pumila*) (Dickerson and Woodruff, 1969). Because of it's rooting system, the adaptability to vaste ecological conditions and the tollerance and resistance to DED, *Ulmus pumila* was widely used on different breeding programs. The selection of superior genotypes reduces genetic variation in cultivated species (Simmonds, 1993; Tanksley and McCouch, 1997). However, when breeding is designed for obtaining plants adapted to diferent environmental conditions and for diferent uses, the outcome could result in an increase of variability (Cox and Wood ,1999; Santini et al., 2008). For example, Siberian elm (*Ulmus pumila* L.; $2n = 2x = 28$) is highly adaptable and tolerant to DED (Smalley and Guries, 1993) and yet it has the potential to be an aggressive invader of disturbed areas throughout North America (Ding et al., 2006) (Zalapa, 2009).

Elms are ring-porous trees in which water conduction is almost entirely restricted to the large, very efficient earlywood vessels of the most recent growth ring (Ellmore and Ewers, 1985). There are two factors that infence the vulnerability to injury: the size and their superficial location, because large vessels are more vulnerable to cavitation than narrow vessels, so, embolisms are occurring by wounding, winter freezing, water stress and vascular diseases (Gibbs, 2001; Tyree and Zimmermann, 2002; Solla et al, 2005).

The multiplication process is very easy because researchers proved that formation of in vitro roots prior to acclimatization is not needed, the vegetative propagation being very efficient. This result may be due to mechanical damage of roots during transfer of plants to soil (Conde et al., 2008). Researchers proved poorer quality of micropropagated plants than roots formed to ex vitro propagated plants (Bonga and Von Aderkas, 1992), while others reported that the in vitro rooting stage could be eliminated to reduce time and cost (Conde et al., 2008). Among recent years, cultivars like 'Urban', 'Dynasty', 'Homestead', 'Pioneer', 'Frontier', 'Prospector', 'Pathfinder', 'Ohio', Arno', "Cathedral', 'Coolshade', 'Fiorente', 'Homestead', 'Lincoln', and many others, obtained by hybridization were released to commerce. Advanced generation crosses have been made in order to combine tolerance to Dutch elm disease with resistance to the elm leaf beetle (Townsend and Santamour, 1993; http://en.wikipedia.org/wiki/Ulmus_pumila).

## CONCLUSIONS

Based on the sintetis of information presented, can conclude that siberian elm is a valuable species that easily adapts to environmental conditions and moreover, it has a positive influence in improving the urban microclimate. This influence is particularly noticeable in purifying the air and absorption of heavy metals in the soil (Lu et al., 2003, Solla et al., 2005, Lu et al., 2010). Due to its qualities, *U. pumila* has become in the recent years, a species commonly used in the hybridization process to obtain new cultivars but also in landscaping frequently encountered in hedges.

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