

Emilio Badalamenti

## Notes about the naturalization in Sicily of *Paulownia tomentosa* (*Paulowniaceae*) and remarks about its global spread

### Abstract

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*Paulownia tomentosa* is native to different regions of East Asia. Here, the first case of natural regeneration in Sicily is reported. Although *Paulownia* is not still invading typically Mediterranean areas, mainly due to ecological constraints, its recognized invasiveness at a global level impose the need to monitor the ongoing process.

*Key words*: invasive alien species, woody plants, Mediterranean, Princess Tree.

### Introduction

Biological invasions occupy a remarkable place among the causes of alteration of ecosystems and reduction of biodiversity on a global scale. The spread and impacts by invasive alien species (IAS) seem to be bound to exacerbating in the next decades, due to the increases in global trade and tourism pressure (Lambdon & al. 2008), as well as due to the promoting effect played by the climate change and the modification of disturbance regimes. IAS are particularly suited to face rapid changes in environmental conditions and disturbance is regarded as one of the most influential factors for invasive success. This helps explain why urban habitats, including Mediterranean ones, are particularly prone to plant invasions. Mediterranean coastal cities are very exposed to invasive species also due to the high rates of plant introduction and the many introduction pathways (Domina & Mazzola 2008; Badalamenti & al. 2014; Pasta & al. 2017), which considerably increased the likelihood of naturalization of alien plants there (Lambdon & al. 2008). Since urban areas have been sometimes the first sites where the naturalization of plant species occurred, even by those taxa which turned out to be invasive, the observation of the early signs of natural regeneration could be important even there. This could allow to follow the invasion process from the beginning, better understanding the possible evolution of invasive tendencies. In the last decades, the number of casual or naturalized alien trees has steadily increased in Sicily (e.g. Scafidi & al. 2016; Badalamenti & La Mantia 2018). As

part of specific surveys on alien flora of Sicily, the first records of natural regeneration of *Paulownia tomentosa* (Thunb.) Steud. (hereinafter *Paulownia*) are here reported.

## Material and methods

In the last 4 years, periodic observations of mature trees were randomly carried out in green areas of Palermo (parks and gardens) where *Paulownia* is cultivated. Only individuals clearly originating from seed were considered. Systematics and nomenclature follow APG IV (2016).

## Results and Conclusions

During periodic surveys ca. 10 self-sown individuals of *Paulownia* were found. Natural regeneration exclusively occurred at the base of walls or sidewalks, where some water and nutrients may accumulate. Seedling establishment was confined to ecological conditions characterized by thermal and water stress, in full light and low plant competition. The height of detected individuals ranged from 15-20 cm up to 1.5 m, and they have been found up to 120 m of distance from mother plants. *Paulownia* is the only genus within the *Paulowniaceae* family, encompassing six woody species coming from East Asia, including *Paulownia tomentosa* from East China, Korea and Japan (Zhao-Hua & al. 1986). *Paulownia* thrives in areas characterized by mean annual temperatures of 11-17 °C, mean annual rainfall of 500-1,500 mm and length of the dry period from 3 to 9 months. In the native habitats, the species colonizes mesophilous sites, such as forests, ravines and open valleys, and it represents a minor component of hardwood forests (Zhao-Hua & al. 1986). *Paulownia* is a pioneer species characterized by juvenile fast growth and sprouting ability, relatively short lifespan (60-70 years), early achievement of sexual maturity (8-10 years), and abundant production of easily wind-dispersed seeds (Essl 2007).

*Paulownia* has been widely introduced outside Asia for its impressive flowering, as well as for its hardiness to abiotic stresses and fast-growing. It was firstly introduced to Europe in 1834 (Ostinelli 1910), and from there to United States (US). Although these regions have shared the introduction period and its main purpose, they have been affected by notably different invasive patterns. In the US, the species underwent to a rapid naturalization process and has invaded man-made sites, but also semi-natural and natural habitats, such as xerophilous rocky cliffs, forest edges and gaps, and stream banks. *Paulownia* is extremely able to exploit disturbance (especially wildfires), giving rise to massive spread and large-scale invasion processes, threatening native species and ecosystems (Kuppinger & al. 2010). Other areas in the world where *Paulownia* has significantly escaped from cultivation include Hawaii and NE Australia (Randall 2017). In Europe, until recently *Paulownia* had been only found in disturbed and anthropic habitats such as railways, wall crevices, and ruderal vegetation, whereas rarely invading river banks or afforestations (Essl 2007). However, the notable increase in the records of natural regeneration in the last few decades suggests that the full naturalization in temperate central Europe, as well as the entry within semi-natural and natural habitats are highly expected (Essl 2007).

*Paulownia tomentosa* (sub *Paulownia imperialis* Siebold.) is present in Sicily at least since 1858, when it was cultivated in the Palermo Botanical Garden (Todaro 1858). Subsequently,

the species has been rarely used for ornamental purposes in green areas (parks and villas) and urban spaces (squares and streets). It is currently cultivated in Alimena, Isnello, and Palermo (province of Palermo), Trapani (province of Trapani), Mistretta and Vulcano (province of Messina) (Rossini-Oliva & al. 2002; Bazan & al. 2005; Domina & Mazzola 2008). *Paulownia* has been introduced to Italy in 1843 (Ridolfi 1843 in Maniero 2000). Nowadays, it is found in the floras of 15 out of 20 Italian regions (Galasso & al. 2018), where it has mostly invaded ruderal sites, dry and exposed areas and urban contexts (e.g. Olivieri 2017). Notably, the species has been included in the management list of invasive alien plants in Piedmont (DGR 33-5174, 12/06/2017), for its adverse impacts on biodiversity and buildings.

There is large uncertainty about the future behavior of *Paulownia* in Mediterranean-climate areas (Crosti & al. 2010). One of the possible reasons is its prevalent use as an ornamental species, which makes most natural environments physically unreachable. According to Essl (2007), both the origin and the naturalization process of *Paulownia* resemble the history of *Ailanthus altissima* (Mill.) Swingle; they were also found together invading the synanthropic vegetation of mesic habitats, as well as mixed broad-leaved forests. However, *Ailanthus* has proven to be particularly suited to establish within Mediterranean ecosystems (e.g. Badalamenti & al. 2015). Conversely, *Paulownia* does not seem to be equipped to cope with Mediterranean drought period. Indeed, the expected rise of average temperatures due to climate change, which likely will favor its spread northward, may represent one limiting factor in Mediterranean ecosystems as *Paulownia* would require water during the warm season (Zhao-Hua & al. 1986). However, introduced plants may experience considerable shifts in the ecological behavior even many years after the introduction.

In conclusion, the observation of some self-sown individuals suggests that *Paulownia* should be considered as a casual alien species in Sicily. Its recognized invasiveness at a global level impose the need to monitor the ongoing process (Randall 2017).

### *Specimina visa:*

ITALY (SIC): Palermo, Campus of University (WGS84 38°06'16.10"N, 13°20'57.13"E), 44 m a.s.l., wall base, 10 May 2016, *E. Badalamenti s.n.* (SAF!).

### References

- Angiosperm Phylogeny Group IV. 2016: An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. – *Bot. J. Linn. Soc.* **181(1)**: 1-20.
- Badalamenti, E. & La Mantia, T. 2018: *Handroanthus heptaphyllus* (Bignoniaceae) in Sicily: a new casual alien to Italy and Europe. – *Fl. Medit.* **28**: 331-338. <https://doi.org/10.7320/FIMedit28.331>
- , — & Quatrini, P. 2015: Arbuscular mycorrhizal fungi positively affect growth of *Ailanthus altissima* (Mill.) Swingle seedlings and show a strong association with this invasive species in Mediterranean woodlands. – *J. Torrey Bot. Soc.* **142(2)**: 127-139. <https://doi.org/10.3159/TORREY-D-14-00034.1>
- , Gristina, L., La Mantia, T., Novara, A., Pasta, S., Lauteri, M., Fernandes, P., Correia, O. & Maguas, C. 2014: Relationship between recruitment and mother plant vitality the alien species *Acacia cyclops* A. Cunn. ex G. Don. – *For. Ecol. Managem.* **331**: 237-244. <https://doi.org/10.1016/j.foreco.2014.08.016>

- Bazan, G., Geraci, A. & Raimondo, F. M. 2005: La componente floristica dei giardini storici siciliani. – *Quad. Bot. Amb. Appl.* **16**: 93-126.
- Crosti, R., Cascone, C. & Cipollaro, S. 2010: Use of a weed risk assessment for the Mediterranean region of Central Italy to prevent loss of functionality and biodiversity in agro-ecosystems. – *Biol. Invas.* **12**: 1607-1616. <https://doi.org/10.1007/s10530-009-9573-6>
- Domina, G. & Mazzola, P. 2008: Flora ornamentale delle isole circumsiciliane. – *Quad. Bot. Amb. Appl.* **19**: 107-119.
- Essl, F. 2007: From ornamental to detrimental? The incipient invasion of Central Europe by *Paulownia tomentosa*. – *Preslia* **79**: 377-389.
- Galasso, G., Conti, F., Peruzzi, L., Ardenghi, N. M. G., Banfi, E., Celesti-Grappow, L., Albano, A., Alessandrini, A., Bacchetta, G., Ballelli, S., Bandini Mazzanti, M., Barberis, G., Bernardo, L., Blasi, C., Bouvet, D., Bovio, M., Cecchi, L., Del Guacchio, E., Domina, G., Fascetti, S., Gallo, L., Gubellini, L., Guiggi, A., Iamónico, D., Iberite, M., Jiménez-Mejías, P., Lattanzi, E., Marchetti, D., Martinetto, E., Masin, R. R., Medagli, P., Passalacqua, N. G., Peccenini, S., Pennesi, R., Pierini, B., Podda, L., Poldini, L., Prosser, F., Raimondo, F. M., Roma-Marzio, F., Rosati, L., Santangelo, A., Scoppola, A., Scortegagna, S., Selvaggi, A., Selvi, F., Soldano, A., Stinca, A., Wagensommer, R. P., Wilhalm, T. & Bartolucci, F. 2018: An updated checklist of the vascular flora alien to Italy. – *Pl. Biosyst.* **152(3)**: 556-592. <https://doi.org/10.1080/11263504.2018.1441197>
- Kuppinger, D. M., Jenkins, M. A. & White, P. S. 2010: Predicting the post-fire establishment and persistence of an invasive tree species across a complex landscape. – *Biol. Invas.* **12**: 3473-3484. <https://doi.org/10.1007/s10530-010-9745-4>
- Lambdon, P. W., Lloret, F. & Hulme, P. E. 2008: How do introduction characteristics influence the invasion success of Mediterranean alien plants? – *Persp. Plant Ecol. Evol. Syst.* **10**: 143-159. <https://doi.org/10.1016/j.ppees.2007.12.004>
- Maniero, F. 2000: *Fitocronologia d'Italia*. – Firenze.
- Olivieri, N. 2017: Notulae to the Italian alien vascular flora: 3. – *Italian Botanist* **3**: 61. <https://doi.org/10.3897/italianbotanist.3.13126>
- Ostinelli, V. 1910: *Villa Trabia*. –Palermo.
- Pasta, S., Ardenghi, N. M. G., Badalamenti, E., La Mantia, T., Livreri Console, S. & Parolo, G. 2017: The alien vascular flora of Linosa (Pelagic Islands, strait of Sicily): Update and management proposals. – *Willdenowia* **47(2)**: 135-144. <https://doi.org/10.3372/wi.47.47205>.
- Randall, R. P. 2017: *A global compendium of weeds*, 3<sup>rd</sup> Ed. – Perth.
- Rossini-Oliva, S., Valdés, B. & Raimondo, F. M. 2002: Las plantas americanas en los jardines de Sicilia Occidental (Italia). – *Lagascalía* **22**: 131-144.
- Scafidi, F., Di Gristina, E. & Domina, G. 2016: *Malvaceae* (incl. *Sterculiaceae*). – P. 429 in: Von Raab-Straube, E. & Raus, T. (eds.), *Euro Med-Checklist Notulae*, 6. – *Willdenowia* **46(3)**: 423-442. <http://dx.doi.org/10.3372/wi.46.46310>
- Todaro, A. 1858: *Index Seminum R. Horti Botanici Panormitani. An. MDCCCLVII. Quae pro mutua commutatione offeruntur*. – Palermo.
- Zhao-Hua, Z., Ching-Ju, C., Xin-Yu, L. & Yao, X. 1986: *Paulownia* in China. Cultivation and utilization. – Beijing.

Address of the author:

Emilio Badalamenti,

Department Agricultural, Food and Forest Sciences, University of Palermo, Viale delle Scienze Ed. 4, 90128 – Palermo, Italy. E-mail: [emilio.badalamenti@unipa.it](mailto:emilio.badalamenti@unipa.it)