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Original article

Poisonous and allergenic plant species in preschool's and primary school's yards in the city of Novi Sad

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ABSTRACT

Presence of the poisonous and allergenic plant species was observed in 8 primary schools and 6 preschools in Novi Sad, Serbia. The aim of this research was to determine the extent to which pre-school and school-age children are exposed to harmful plant species and also to gain insight does the present landscaping take into account the appropriateness in the use of certain ornamental species in arranging preschool's and school's greenery. In the analyzed locations 22 poisonous plant species were noticed, mainly belonging to genera *Thuja*, *Symphoricarpos*, *Cotoneaster*, *Juniperus*, *Berberis* and *Taxus*, represented with 367 specimens. Along with poisonous, 21 allergenic plant species mainly belonging to genera *Acer*, *Tilia*, *Betula*, *Populus*, *Platanus*, *Celtis*, *Aesculus*, *Thuja*, *Ulmus*, *Robinia* and *Quercus*, represented with 675 specimens, were determined. The calculated allergenic index grouped most of the investigated species into strongly allergenic (calculated A.I. = 7) due to their prolonged phenantesic period, high abundance and possible cross-reactivity with other species noticed in the greenery. Establishment and enhancement of the collaboration between schools and experts from relevant institutions would result in the removal of the very most allergenic and poisonous landscape plants and ultimately toxic-free and allergy-friendly school yards. Gradual removal might temper the public reluctance to this measurement, but finally only joint efforts and complete abandonment of pointed species can convert unhealthy school yards into ones that are safe and allergy-friendly.

1. Introduction

Appropriately designed outdoor spaces of educational institutions are important for mental and physical development as well as children's health. Greenery is significant component of open spaces. It enriches the environment in which children reside, creates a healthy micro-climate that protects from harmful external influences (dust, gases, noise and extreme temperatures) and provides children contact with nature (Anastasijević, 2007). Thereby, serious approach in planning and designing educational institution's yards, which among other things includes careful selection of plant species, is necessary.

According to American Association of Poison Control Centers database, analyzed for the period 2000–2008, 3.4% of all poisoning in the United States was due to plants and nearly 70% of victims were children under the age of six (Petersen, 2011). Studies in some European countries were carried out as well (Vichova and Jahodar, 2003; Lamminpää and Kinos, 1996). Study conducted in Germany, from 2001 to 2010 reported 13001 plant exposures of which over 85% cases involved children (Plenert et al., 2012). Plant toxicity derives due to the presence of toxic compounds such as alkaloids, glycosides, saponins, oxalates and etc (Douglas, 2005; Dražić, 2002). Although the number of poisoning cases registered suggests that their incidence has been decreasing in recent decades, plant poisoning can't be underestimated. Contact with these plants can cause skin and/or eyes irritation or even consummation poisoning. Toxicity varies due to maturation stage and toxic compounds content in different plant parts. Thus, certain amounts of the poison entered can be almost harmless for adults but lethal to children (Filmer, 2012; Grlić, 1984). Sometimes plant poisoning may not be properly identified, since general population has scarce knowledge about the toxicity of plants commonly present in their environment. When it comes to children's poisoning, sometimes the symptoms are not at first associated with exposure to a plant and the exposure may not even be witnessed by the adults (Monseny et al., 2015).

Disorders and changes in the immune system functioning caused by allergens lead to allergic reactions (Igić, 2012; Nestorović et al., 2011). Pollen in more than 20% of the human population causes allergic reactions (bronchitis, conjunctivitis, dermatitis, hay fever), while long term exposure to high concentrations can cause chronic bronchitis and

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bronchial asthma (Zrnić, 2010). Cariñanos and Casares-Porcel (2011) stated some of major causes of allergenicity: low species biodiversity at planting reflected as the overabundance of certain species acting as pollen sources; male individuals utilization in dioecious species; the presence of invasive species; exotic species introduction; the appearance of cross-reactivity between species; lack of garden management and maintenance and the interaction between pollen and air pollutants. According to 'Report on the pollen counts' in the city of Pančevo (Serbia) in 2012, limiting value for concentrations of pollen grains in air for all allergenic plants should be 30 pollen grains per 1 m^3 of air. Except for ragweed (*Ambrosia artemisifolia* L.), for which 15 pollen grains per 1 m^3 of air are critical. Concentrations of pollen grains in air above those values carry risk of allergic reactions.

The aim of this research was to determine the extent to which preschool and school-age children are exposed to harmful plant species and also to gain insight does present landscaping take into account the appropriateness in the use of certain ornamental species in arranging preschool's and school's greenery in Novi Sad.

2. Material and methods

2.1. Analyzed locations

Presence of poisonous, allergenic and invasive plant species was observed in 14 educational institutions (Fig. 1), 8 primary schools and 6 preschools. The survey covered 10 city districts in the City of Novi Sad (45°15′18″N 19°50′41″E) – Liman I, Liman II, Liman III, Grbavica, Adamovićevo naselje, Sajmište, Novo Naselje, Satelit, Rotkvarija and Klisa (Fig. 1). In each location species affiliation and specimens number was determined (Table 1). The city of Novi Sad was analyzed as an exemplary study illustrating the general trend in preschools and school's greenery landscaping in previous period.

2.2. Greenery assessment

Dendrological determination was carried out according to Ocokoljić and Ninić-Todorović (2003). Data concerning poisonous plant species was obtained from Grlić (1984), Kojić and Janjić (1991), Dražić (2002) and Filmer (2012). Allergenic plant species were determined according to Igić et al. (2005), Igić (2012), Nestorović et al. (2011) and Zrnić (2010).

Analysis included data from field research and was complemented with information obtained using literature. For recorded poisonous species, parts of plant that contain toxins were specified. Toxicity class was defined according to modified classification proposed by Filmer (2012): (A) plants with major toxic effect that may cause serious illness or death, (B) plants with minor toxic effect, ingested cause vomiting or diarrhea, (C) plants whose oxalate crystals ingested can irritate mouth, tongue and throat, resulting in throat swelling, breathing difficulties, burning pain and stomach upset (D) sap or thorns of these plants may cause a skin rash or irritation. With respect to allergenic pollen production potential, determined species were divided into three groups denoted as high, moderate or low potential.

For those species the allergen index value (A.I.) was calculated according to Hruska (2003), taking into account several distinguished parameters. This is a modified 1–10 numerical plant-allergy scale first

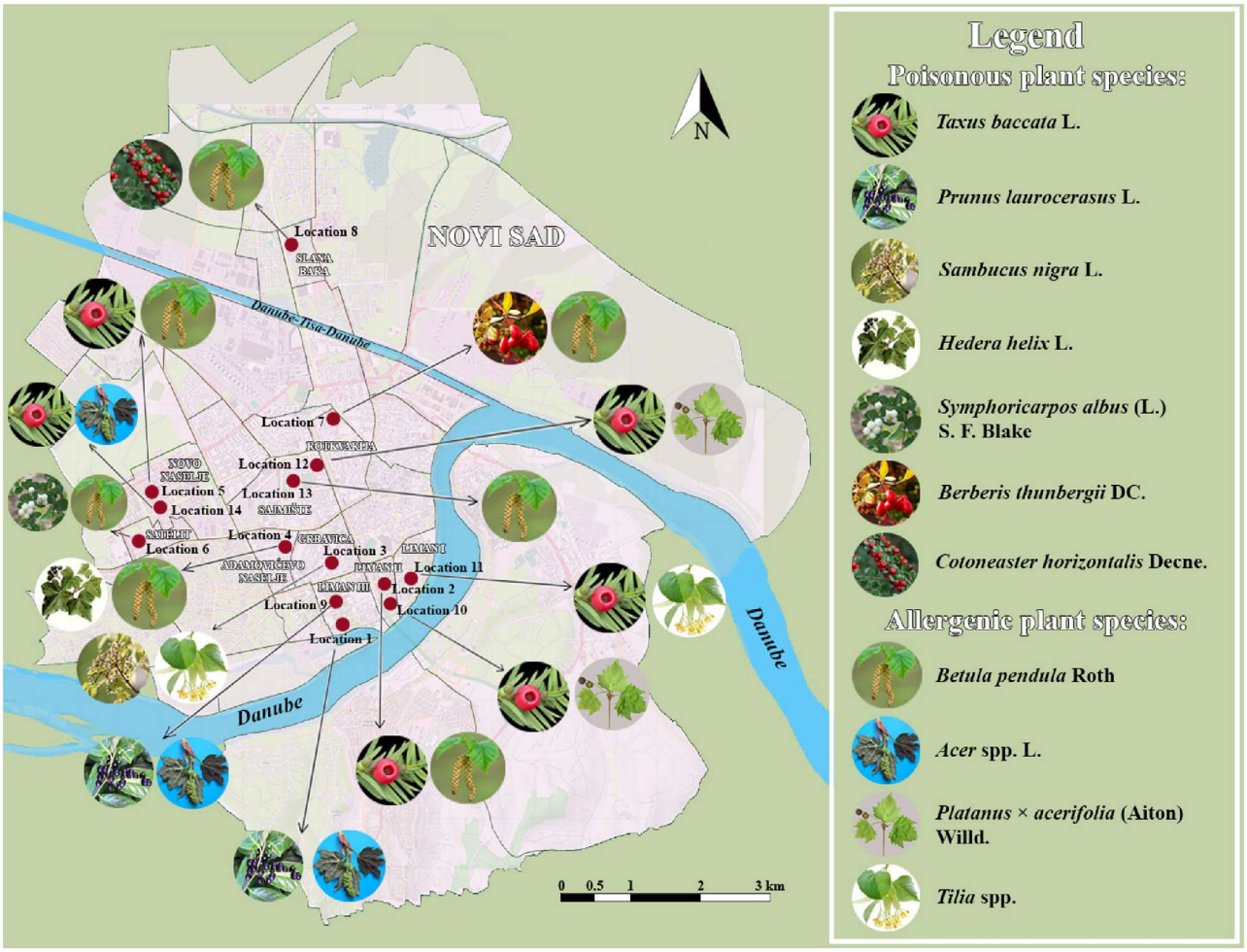

Fig. 1. Distribution of the investigated locations across the City of Novi Sad with graphical illustration of the most abundant poisonous and allergenic plant species for the given localities.