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TOXIC PLANT SPECIES IN PARKS LOCATED IN CITY CENTRE OF BUCHAREST

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Abstract

Population tends to associate the term of toxicity in urban space exclusively with the pollution. Although pollution has as a counter-effect the existence of as much plants as possible, sometimes plants themselves have toxic parts. The aim of this research was to highlight quantitatively and qualitatively the presence of these species in the parks located in the centre of Bucharest. As a result, it was concluded that there is a worrying number of toxic plant species present in these areas, especially in those more frequented by visitors such as: children playgrounds, resting places and alleys. In addition, plant species with psychotropic effects have been found in all parks studied, some of them toxic enough to present health risks at recreational doses. These could have serious implications in Romania, where the use of new psychoactive substances (NSP) or more generally 'ethnobotanicals', occupies the second place in the top, after cannabis.

Key words*: health, psychotropic effects, toxic plants, urban park.*

INTRODUCTION

In cities, air pollution is generally considered the most important source of toxicity with a major impact on environment and population health (Schwela, 2000; Brunekreef et al., 2009; Ghorani-Azam et al., 2016). Green spaces, which have an essential role in reducing air pollutants and thus, toxicity, are often made up of species that are equally harmful to human health as pollution, through the toxins they naturally contain. Some of these poisonous species are native and better known by the rural population, which avoid them. But the urban people are fewer opportunities to interact with nature (Soga-Gaston, 2016) and learn about plant species. However, along with native species, public parks and gardens in urban area contain a large number of highly decorative exotic species, from American, eastern Asia or Africa flora, which are most rich in poisonous species than European flora (Anadón et al., 2018; Panter et al., 2012). Fortunately, most plant species present in Romanian parks and gardens, cause poisoning only when are consumed or inhaled (Zanoschi et al., 1981; Hanganu and Popescu, 2002; Iliescu, 2008). However, this possibility should not be neglected. Children are more vulnerable to plant poisoning, being tempted to taste certain fruits or seed of ornamental species from garden or parks. For some of them, this curiosity turned into an unpleasant experience, even with the ingestion of small amounts of fruits or seeds from toxic species, requiring emergency medical help (Konca et al., 2014; Giménez et al., 2017; Neveu et al., 2018; Mirakbariand Shirazi, 2019).

Another group of risk for accidental poisoning with plants in parks and gardens are small pet animals – dogs and cats, which ingest accidentally seeds, pits, bulbs, branches and even leaves (Gault et al., 1995; Ferreiro et al., 2010). Animals may experience various symptoms of intoxication and even dead, depending on the species, age, health status, amount ingested. Anyway, all puppies taste anything in nature and are therefore more often victims of toxic plant material (Anadón et al., 2018).

Accidental intoxications may also suffer some other groups of visitors of public garden and parks: people who collect plants for special diets (raw food or vegan), tea or other

medicinal use and maintenance personal of these green spaces.

Some of the ornamental toxic plants present in urban parks and garden have also psychotropic effects when are consumed or smoked. In Romania, the use of new psychoactive substances (NSP) or more generally 'ethnobotanicals', occupies the second place in the top, after cannabis (ANA, 2017). According to the national report on drugs situation in 2017, 91% of the 'ethnobotanicals' users are young people. Unfortunately, in such situation toxicity may be fatal, especially when consumers use a mix of those plants and make impossible for doctors to identify toxins and treat the victims.

Toxicity of the ornamental plants derives due to the presence of different compounds (alkaloids, saponins, oxalates, glycosides and etc.) produced to preserve their integrity or to resist at some stress factors (Iliescu, 2008). Toxin concentrations vary among plants, seasons and years. One of the factors of these variations may be linked to environmental conditions (Stegelmeier et al., 2013).

The objective of this paper was to highlight quantitatively and qualitatively the presence of toxic plant species in the parks located in the centre of Bucharest.

MATERIALS AND METHODS

The present study was carried out in Bucharest (44°24'49"N and 26°05'48"E), which has an area of 228 km^2 and a population of 1.9 million people. About 70% of city area is built (PMB, 2018). Six urban parks situated in the inner city of Bucharest were analysed for the presence of toxic plant species: Izvor Park, Cismigiu Park, Unirii Park, Ion Voicu Park, Icoanei Park and TNB Park. These parks with different size (ranging from 7000 m^2 to 17 ha) are intensively frequented by visitors in every season of the year, being true oases of greenery into an extremely built and polluted area. Children and young people spent daily some hours in one of these parks, which are very close to three general schools, seven high schools and a university.

Identification of the species was carried out according to Dumitrascu (2007), Iliescu (2008) and Toma (2012). For each location, all plant specimens, separated in trees, shrubs, flower plants, were recorded to determine the proportion of existing plant species from the total number.

Toxic plants were classified in four classes of toxicity according to Filmer (2012): Class 1, major toxicity – plants which may cause serious illness or death; Class 2, minor toxicity – ingestion of these plants may cause minor illnesses such vomiting or diarrhea; Class 3, oxalates – the juice or sap of these plants contains oxalate crystals, that can irritate the skin, mouth, tongue and throat, resulting in throat swelling, breathing difficulties, burning pain, and stomach upset; Class 4, dermatitis – the juice, sap or thorns of these plants may cause a skin rash or irritation.

For each park, presence of toxic plants was marked on a map in order to establish the frequency of these plants in different locations of interest for the visitors.

Species with psychotropic effects found in parks were also recorded and marked on maps.

RESULTS AND DISCUSSIONS

Results showed the presence of toxic plants in all six urban parks studied. However, different proportion of toxic plants can be found in these areas (Table 1). The greatest diversity of toxic plant species was identified in Cismigiu Park, 52 species, representing 48% from the total number of species of this park. The lowest diversity of toxic species was recorded in Ion Voicu Park and Icoanei Park with 18 and 16 species, respectively. Anyway, reported to the total number of species in each park, it was found that all parks have between 45-55% toxic plant species.

The most frequent poisonous plant species found in the floristic composition of the six urban parks proved to be: *Hedera helix*, *Aesculus hippocastanum* and *Symphoricarpos orbiculatus,* which are present in five of the six parks studied, followed by *Taxus baccata*, *Robinia pseudacacia*, *Mahonia aquifolium*, *Fraxinus americana* and *Acer saccharinum,* present in four of the parks.

In all parks, native toxic species, better known by population and avoided, had a lower share compared to non-native species (Figure 1). More non-native toxic species were recorded in

Unirii Park, with a share of 81%, from the total of toxic species, followed by TNB Park, with a

Table 1. Number of toxic species in each location studied

Park name	Area (m^2)	Total number of species	Number of toxic species
Izvor	170000	68	30
Cismigiu	140000	108	52
Unirii	61000	47	21
Ion Voicu	10000	42	19
Icoanei	10000	29	16
TNB	7700	44	24

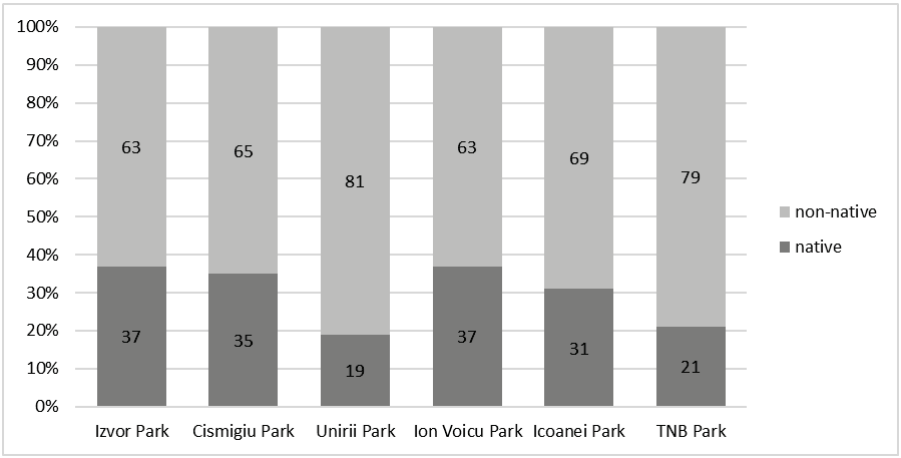

Figure1. Share of native and non-native species in the total toxic species

share of 79%. In remaining studied parks no less than 63% toxic non-native species were identified. Such a predominance of toxic non-native species may increase the risk of poisoning of urban population. Non-native species tend to attract more the attention of parks visitors by their unusual leaves, flowers or fruits. These seem to be inoffensive and safe, people interacting more with these plants, especially when are planted close to alleys or rest places in parks.

Urban parks in centre of Bucharest included 2483 specimens of poisonous plant species. The most populated park with toxic plants was Cismigiu Park, with 907 specimens, followed by Izvor Park, with 602 specimens (Table 2). A reduced number of poisonous specimens was recorded in Icoanei Park, 181 plants.

However, the area of parks is not equal, and also the number of dendroflora specimens. Therefore, a better understanding of the presence of poisonous plants in these parks, the number of toxic specimens was reported to the total dendroflora. Consequently, significant high percentage of toxic plants, over 50%, have been calculated for small parks, such as Ion Voicu (10000 m^3), Icoanei Park (10000 m^3) and TNB Park (7700 m^3). In the last park, main dendroflora (78.0%) is composed of toxic plants. A lower percentage of poisonous plant was calculated for Izvor Park, with 28.6%.

The species with the greatest number of specimens in the parks were: *Fraxinus excelsior*, *Thuja orientalis*, *Mahonia aquifolium*, *Taxus baccata*, *Quercus rubra* and *Buxus sempervirens*. Excepting *Taxus baccata*, the rest of them have low toxicity. Anyway, analysed by class of toxicity, data showed a prevalence of minor toxicity species (class 2) in all studied parks. The greatest number of major toxicity species (class 1) was found in Cismigiu Park, with 200 specimens (about 22% from the total number of toxic species in this park). Many of these specimens belong to *Taxus baccata* and *Vinca minor*, both species with persistent leaves.

Table 2. Toxic plant species and the number of specimens in parks

Toxic plant species	Toxic part	Toxicity class	No. of recorded specimens in parks					
			Izvor	Cismigiu	Unirii	Ion Voicu	Icoanei	TNB
Acer campestre	leaves	4	-	5	-	-	-	-
Acer negundo	leaves	4	8	21	2	18	-	-
Acer palmatum	leaves	4	-	-	-	-	-	2
Acer platanoides	leaves	4	26	2	-	31	-	28
Acer pseudoplatanus	leaves	4	-	4	20	20	-	-
Acer saccharinum	leaves	4	8	-	1	3	4	-
Acer tataricum	leaves	4	-	1	-	-	-	-
Aesculus x carnea	whole plant	2	-	7	-	-	-	-
Aesculus hippocastanum	whole plant	2	8	11	28	15	8	-
Ailanthus altissima	leaves	2,4	9	14	-	-	-	1
Bellis perennis	whole plant	4	beds	beds	beds	-	-	-
Berberis julianae	fruits	2,4	-	7	-	-	-	4
Berberis thunbergii	fruits	2,4	-	-	-	-	10	17
Berberis vulgaris	fruits	2,4	-	4	7	-	-	-
Betula pendula	whole plant	2,4	4	4	-	25	-	18
Buxus sempervirens	leaves	2,4	-	102	14	-	-	15
Chrysantemum spp.	whole plant	2,4	-	-	beds	beds	-	-
Cornus alba	leaves	4	4	-	-	8	-	-
Cornus mas	leaves	4	-	77	-	19	20	-
Cornus sanguinea	leaves	4	-	6	2	-	-	-
Cornus stolonifera	leaves	4	6	-	-	-	-	10
Cotoneaster dielsianus	fruits	2	-	3	-	-	-	5
Cotoneaster dammeri	fruits	2	-	-	-	9	13	-
Cotoneaster praecox	fruits	2	35	-	-	-	-	-
Cotoneaster simonsii	fruits	2	-	5	-	-	-	-
Dianthus chinensis	leaves	2,4	beds	-	-	-	-	-
Euonymus europaeus	fruits	2	-	1	-	-	-	2
Euonymus fortunei	whole plant	2	-	16	-	-	-	-
Euonymus japonicus	whole plant	2	-	-	-	-	-	18
Fraxinus americana	leaves	4	35	-	31	-	-	-
Fraxinus excelsior	leaves	4	114	64	-	-	24	-
Ginkgo biloba	fruits	4	-	6	-	-	-	-
Hedera helix	whole plant	2,4	2	8	-	20	24	20
Heleborus orientalis	whole plant	1,4	-	9	-	-	-	-
Hyacinthus orientalis	bulbs	2,4	beds	beds	-	-	-	-
Hydrangea macrophylla	whole plant	1,4	-	7	-	11	-	-
Iris germanica	rhizome, leaves	2.4	-	-	beds	-	-	-
Juglans regia	leaves	4	12	-	-	-	-	-
Juniperus chinensis	whole plant	2	5	8	-	-	-	-
Juniperus horizontalis	whole plant	2	-	-	-	16	-	33
Juniperus sabina	whole plant	2	7	8	18	-	-	-
Juniperus squamata	whole plant	2	-	-	-	-	10	-
Juniperus virginiana	whole plant	2	-	-	-	-	-	7
Laburnum anagyroides	whole plant	1	1	1	-	-	-	-
Ligustrum ovalifolium	fruits, leaves	2,4	-	10	12	-	-	-
Lonicera tatarica	fruits	2	-	1	-	-	-	-
Lupinus polyphyllus	whole plant	1	24	-	-	-	-	-
Maclura aurantiaca	sap	4	-	5	-	-	-	-
Mahonia aquifolium	whole plant	2,4	-	76	28	12	-	56
Mahonia bealei	whole plant	2	-	11	-	-	-	-
Narcissus spp.	bulbs, stems	2,4	beds	-	beds	beds	-	beds
Parthenocissus quinquefolia	fruits	3,4	-	-	-	33	-	-
Prunus laurocerasus	leaves, fruits	1	-	1	-	-	-	-
Pyracantha crenatoserrata	fruits	2,4	-	3	13	-	-	4
Quercus cerris	leaves, fruits	2,4	11	-	-	-	-	-
Quercus robur	leaves, fruits	2,4	21	1	10	5	10	-
Quercus rubra	leaves, fruits	2,4	93	18	25	-	-	-
Rhododendron spp.	whole plant	1	-	-	-	-	-	7

Toxic plant species	Toxic part	Toxicity class	No. of recorded specimens in parks					
			Izvor	Cismigiu	Unirii	Ion Voicu	Icoanei	TNB
Robinia pseudacacia	bark, leaves, fruits	1	16	6	-	10	12	-
Sabucus nigra	leaves, unripe fruits	1	-	6	-	-	-	-
Senecio cineraria	leaves	2,4	beds	beds	-	-	-	beds
Symphoricarpos orbiculatus	fruits	2	5	25	27	-	5	7
Symphoricarpos albus	fruits	2	-	45	-	-	5	-
Tagetes spp.	whole plant	4	-	-	-	-	-	beds
Taxus baccata	whole plant	1	-	130	-	14	9	12
Thuja occidentalis	whole plant	2,4	-	3	-	-	-	-
Thuja orientalis	whole plant	2,4	127	46	-	-	18	-
Thuja plicata	whole plant	2,4	-	-	-	15	-	-
Torreya nucifera	fruits	1	-	1	-	-	-	-
Tulipa spp.	whole plant	2,4	beds	beds	beds	-	-	beds
Ulmus carpinifolia	leaves	4	15	25	-	-	-	-
Ulmus glabra	leaves	4	6	-	-	-	-	-
Viburnum opulus	leaves, fruits	2	-	-	3	-	-	-
Viburnum rhytidophillum	leaves	2	-	9	-	-	-	-
Vinca minor	whole plant	1	-	40	-	-	-	-
Viola x wittrokiana	whole plant	2	-	beds	-	-	-	beds
Wisteria sinensis	whole plant	2	-	44	-	-	9	-
Total no. of specimens/			602	907	241	284	181	266
Percentage in total plants of parks			28.6%	48.8%	38.5%	55.1%	58.6%	78.0%

Table 3. Plant species with psychotropic effects

Toxic plant species	Toxic part	Substance	No. of recorded specimens in parks					
			Izvor	Cismigiu	Unirii	Ion Voicu	Icoanei	TNB
Acer saccharinum	leaves	tryptamine	8	-	1	3	4	-
Coleus spp.	leaves	unknown	beds	beds	beds	-	-	beds
Corydalis solida	bulbs	bulbocapnine	lawn	lawn	-	-	-	-
Eleagnus angustifolia	leaves	tetrahydroharmol	4	5	-	-	-	-
Hydrangea macrophylla	leaves	cyanide	-	7	-	11	-	-
Lobelia inflata	whole plant	lobeline	-	lawn	-	-	-	-
Vinca minor	whole plant	vincamine	-	40	-	-	-	-

In the rest of the parks, specimens with major toxicity (class 1) were represented in total toxic dendroflora at less than 12%. An important share of specimens that cause dermatitis (class 4 of toxicity) were noted in Izvor Park, with almost 40% of specimens, followed by Ion Voicu Park, with 35% of specimens.

Specimens of plants, which contain toxins in all their parts, such as *Thuja spp*., *Juniperus spp*., *Hedera helix* or *Taxus baccata,* were recorded in all the parks, located especially near alleys and rest places. In four of the studied parks, TNB Park, Izvor Park, Ion Voicu Park and Icoanei Park, the proportion of those plants was significant large, between 45-65%. The potentially toxic risk of these species is greater compared with the others, toxic only by leaves or fruit, which are found seasonally on plant. However, for children most dangerous plants proved to be those with toxic berry fruits (Mrđan et al., 2017; Neveu et al., 2018). Majority of the studied parks have more than one playground, planted randomly with bushes such as *Symphoricarpos spp*., *Euonymus spp.*, *Berberis spp.* or *Cotoneaster spp.,* without considering their toxic risk for children.

Considering the psychotropic effects of some of the species, it was noted their presence in all parks (Table 3).

In Cismigiu Park were recorded the highest number of specimens of this type, potentially attractive for users.

Location of these plants was observed along secondary alleys or at the edge of the park plantations, especially for the herbaceous species like *Corydalis solida* or *Lobelia inflata*. Anyway, many of the herbaceous plants with narcotic effect are fortunately restricted in all the parks due to the presence of the turf.

CONCLUSIONS

Ornamental plant species with toxic parts were identified in all the parks situated in the centre of Bucharest. Our study provides the first quantification of the toxic plant species in Romanian' urban parks, enabling park managers to take various actions (e.g. pruning trees and shrubs, cleaning fallen fruits, using toxic-free flowers for beds) to avoid accidental poisoning. Furthermore, importers of plants, nurseries and landscape architects must understand the importance of safe in public parks and make more responsible and justified the process of species selection for the future plantations.

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