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Urban trees of Tallinn, Estonia

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Abstract. In Tallinn (without Tallinn Botanic Garden) 1275 taxa of native and introduced woody plants have been registered. Out of these 480 taxa are trees. The most widespread tree species is *Pinus sylvestris*. A hundred and forty-two rare trees belonging to 70 species, hybrids, varieties, and cultivars are of a remarkable age and/or dimensions. Among them 71 trees (27 taxa) are younger than 60 years, 41 trees (23 taxa) are 60–80 years old, and 30 trees (20 taxa) are older than 80 years. The species with the oldest specimens, which are over 200 years of age, belong to 5 taxa, 100–200 year old trees to 24 taxa, 60–100 year old trees to 89 taxa, and trees under 60 years of age to 360 taxa. The species with the highest specimens reaching 30–35 m belong to 5 taxa, those of 20–30 m to 35 taxa, and those of 10–20 m to 105 taxa. We have registered about 800 trees with the stem perimeter of 300 cm or more. These trees belong to 11 genera.

Key words: urban trees, predominant trees, rare trees, tree age, dimensions of trees.

INTRODUCTION

The diversity of woody plants in cities is a result of spontaneous development as well as of human activities; still, the latter has played a more important role. Analysis of urban greenery is traditionally based on life forms, and trees are the most important life form among the woody plants. Trees form the city environment,

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their importance is determined by their ecological, recreative, educational, cultural, aesthetic, monetary etc., value (Sukopp, 1978; Masing, 1980; Sukopp & Werner, 1983; Kunick, 1985; Jim, 1987, 1994; Bassuk & Jaenson, 1990; Kowarik, 1992).

The ecological value of urban trees is understood as their ability to participate in the atmospherical, edaphical, and biological processes and to improve the urban environment with their organic life. The recreative role of trees is due to the fact that they influence people in a positive way, being mentally and physically stimulating to them. The cultural value of urban trees refers to their historical role in the development of the cities. Trees are indicators of the urban culture of the respective period and also objects of natural heritage. Trees have an important educational role, they help to promote the ideas of nature conservation.

The value of trees in cities depends on their species, age, dimensions, health, site, etc. It is economically useful for the society if urban trees are long-lived and healthy and look aesthetically beautiful.

The aim of this study is to characterize, by various districts of Tallinn, the urban trees species diversity in Tallinn, the share of the most common tree species, rare trees and distribution of tree age and dimensions by the example of the largest tree specimens.

The study summarizes and generalizes other studies of tree species in Tallinn, published in various publications in 1986–2001 (Elliku & Tarand, 1986; Šestakov, 1986; Šestakov & Tamm, 1986; Tarand, 1986; Tamm, 1988; Sander, 1990, 1998, 2001; Sander & Elliku, 1991; Sander et al., 1996, 2001; Reisner, 1998; Läänelaid et al., 2001).

STUDY AREA

Tallinn, the capital of the Republic of Estonia, is located in the northern part of the country on the coast of the Gulf of Finland, to the south from Helsinki (Finland) and to the west from St. Petersburg (Russia). Tallinn is the largest Estonian city with an administrative area of 158.3 km^2 and about 400 000 inhabitants (2001). The territory consists of densely and sparsely built-up areas (mainly one large compact and some small areas) of high and low buildings, here called "urban" and "suburban" zones (about 60%), and a town border zone (not built-up area), here called "periurban" zone (about 40%).

The green space of today's Tallinn has a very variable habitat and functional structure, it consists of parks, gardens, courtyards, areas of various greeneries (plantings in new districts and small areas between the urban blocks), built-up forests, yards with dense trees and bushes in old suburbs, streets, cemeteries, forests, grasslands, meadows, etc. It is estimated that greeneries cover about 60% in built-up areas and 80% in the town border zone.

Tallinn lies at the northern border of the hemiboreal vegetation zones (Ahti et al., 1968). A comparison of 100 European cities showed that Tallinn together with Oslo, Stockholm, Helsinki, St. Petersburg, and Riga belongs to a group treated as the maritime Baltic cold "subclimaton" (Hubalek & Horakova, 1991).

MATERIAL AND METHODS

The gathering of the dendrological data analysed in this work started in the late 1970s at the Tallinn Botanic Garden (where the herbarium of woody plants was stored). The gathering and publishing of dendrological data has continued ever since. The latest data were stored mainly in 2001.

During the inventory of urban trees and bushes the species-rich collections (without Tallinn Botanic Garden), Old Town and city parks and greeneries around the Old Town, parks of former summer estates, gardens and courtyards of former suburbs (Kalamaja, Kadriorg, and Süda–Tatari) as well as green areas of new districts (Lasnamäe, Mustamäe, and Väike-Õismäe) and cemeteries (altogether about 600 ha) were systematically investigated (Fig. 1). Woody plants were determined mostly during field works. Specimens of more complicated taxa were herbarized and determined indoors. Cultivars of *Clematis*, *Rosa*, *Syringa*, *Malus*, *Prunus*, *Pyrus*, *Ribes*, and *Rubus* were not determined.

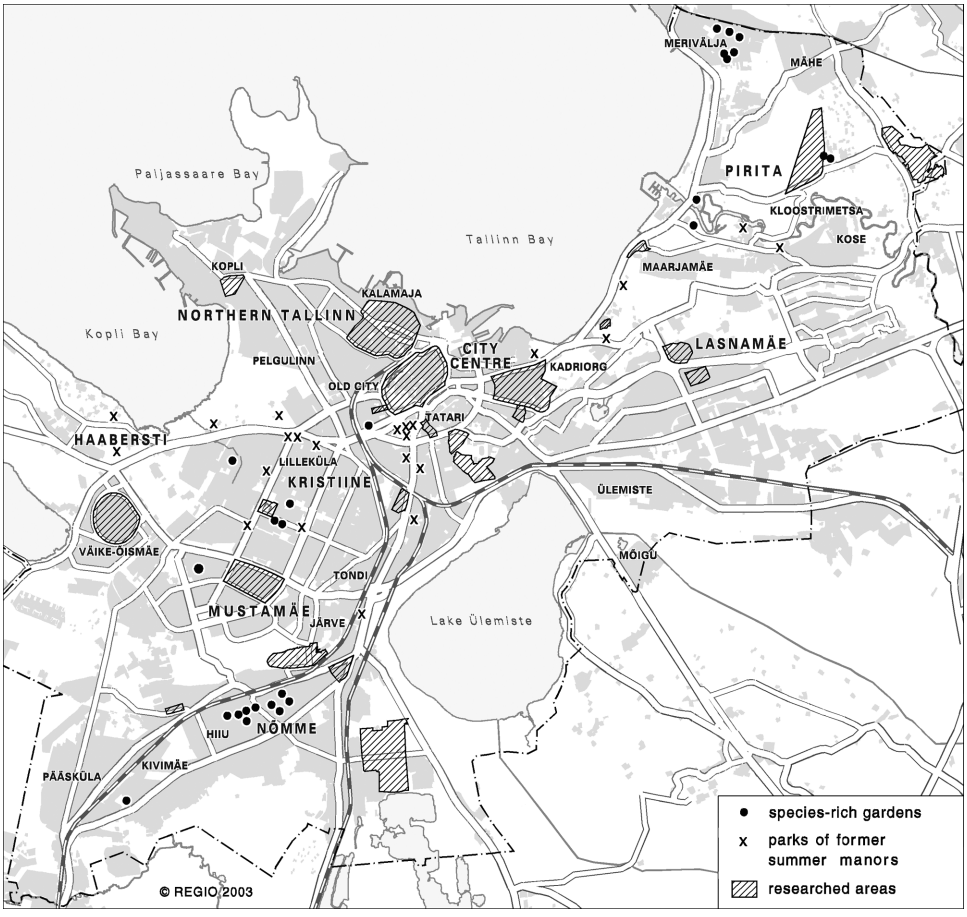

Fig. 1. Researched areas.

Tree height was measured from the ground to the tip of the highest shoot of the crown using the instrument "Suunto". The measuring distance was predominantly 20 m, occasionally 15 m. Measurements at a distance of 30 m were taken for checking tree heights over 20–25 m. Measurement results for trees with a height in excess of 30 m were corrected, since our studies revealed that with a tree height of more than 30 m the measurement error of the instrument "Suunto" started to grow rapidly. As a comparison, tree heights were also measured using an electronic tachymeter GTS 601 (Relve, 2000).

Tree thickness was measured as the perimeter at 1.3 m from the ground. If a larger knot or branch stub was situated at 1.3 m, the thickness was measured below this height. If a tree branched at a lower height, the perimeters of the branches were measured at a height of 1.3 m.

The details of the methods used for determining the tree age by radial increment, and of oaks by bark thickness and trunk perimeter are described in Rohtla (1998) and Läänelaid et al. (2001). Apart from these two methods, old maps of Tallinn and historical data were also used in the determination of tree ages.

RESULTS

Species richness and predominant trees

In Tallinn 1275 taxa of native and introduced woody plants have been registered. We consider 480 taxa (37.6%) of these 1275 taxa to be life forms of trees, out of which 31 are native (6.5%) and 449 introduced taxa. There are 140 taxa of coniferous and 340 taxa of deciduous trees (Fig. 2).

The largest number of tree taxa was registered in gardens. For example, in the gardens of Mati Laane (Sompa tee 33) and Peeter Viikholm (Sompa tee 8), which are two most species-rich gardens in Tallinn, there were in total 864 taxa of woody plants; 296 taxa (34.3%) of these can be considered to be life forms of trees, including 107 taxa of coniferous trees.

Species richness and diversity can be analysed in more detail by the example of the Old Town (Toompea and downtown), the green belt sorrounding it (together with the rows of trees in alley-ways bordering it), three old city districts (Süda–Tatari, Kalamaja, and Kadriorg), and the new districts (Mustamäe, Õismäe, and Lasnamäe, founded after 1960) (Table 1).

The area of Süda and Tatari streets and the district of Kalamaja were built up already in the Middle Ages. The present buildings and greenery of the area of Süda and Tatari streets originate from the second half of the 19th century. The buildings of Kalamaja were partly demolished in 1854 during the Crimean War because of the fear of landing of troops and were later built up again. The early inhabitation of Kadriorg started in the second quarter of the 18th century. How-

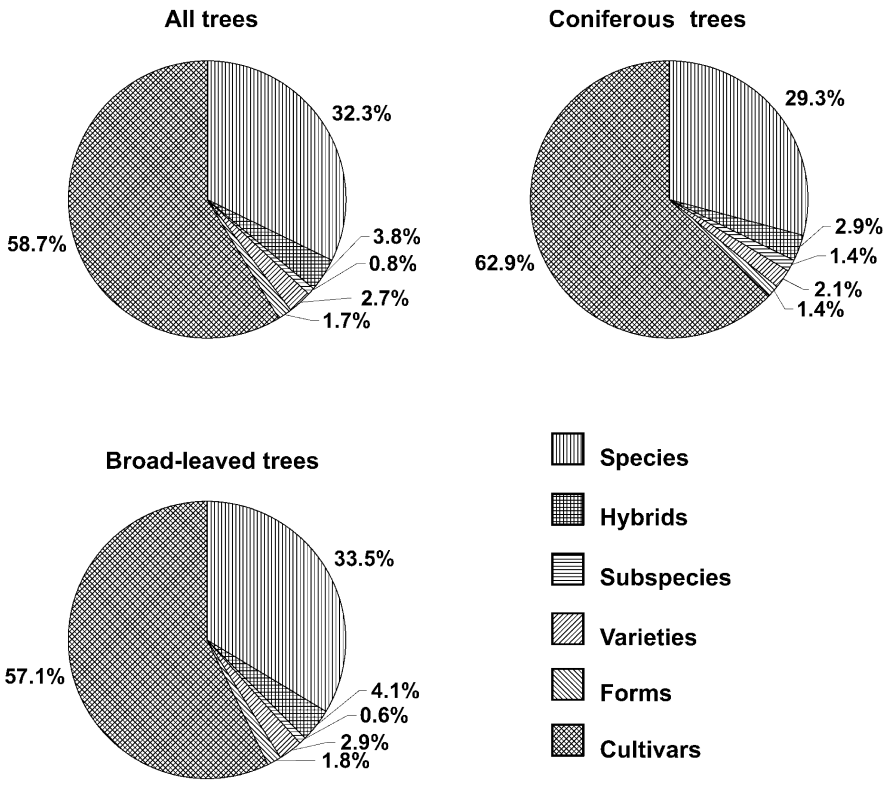

Fig. 2. Taxonomic composition of trees in Tallinn.

Table 1. Registered trees in areas where detailed inventories have been conducted

City district	Inves-tigated area, ha	Taxa of trees			All trees			Introduced trees	
		No.	Conifers		No.	Conifers		No. of taxa	No. of trees
			No.	%		No.	%		
Old Town	34	45	4	8.9	773	41	5.3	32	384
Greenery around Old Town	39	92	13	14.1	4 152	192	4.6	65	2 030
Süda–Tatari	15	47	7	14.9	632	26	4.1	33	262
Kalamaja	74	69	12	17.4	5 154	121	2.3	50	2 903
Kadriorg	47	81	15	18.5	4 131	162	3.9	62	1 621
Mustamäe	47	58	13	22.4	3 675	235	6.4	41	874
Väike-Õismäe	57	46	12	26.1	2 773	309	11.1	33	892
Lasnamäe	80	58	15	25.9	2 697	478	17.7	42	1 040
Total	393	140	18	12.9	23 987	1 564	6.5	101	10 006

ever, most of the buildings there were constructed and greeneries developed at the end of the 19th century and during the first decades of the 20th century.

On the studied area of 393 hectares 23 987 trees belonging to 140 taxa were recorded. Among them there were only 1564 coniferous (6.5%) trees from 18 taxa. These are mainly planted trees. As to planted trees, these include all the trees in the investigated area at Õismäe, 3/4 of the trees at Mustamäe, and the majority of the trees in the other five areas.

The greenery around the Old Town with its 92 taxa is the richest in species, followed by Kadriorg with 81 taxa. However, the former figure shows the earlier richness in species as relatively few additional trees have been planted there after the green belt was completed at the end of the 1930s. On the other hand, it also demonstrates that species-richness has dropped in the Kadriorg district, which with its yards and small gardens used to be the most cared for and species-rich district in Tallinn. The reason is that greeneries have been renewed very little or practically not at all. However, to some extent extreme climatic changes have played their part in the decreased species-richness of both the above districts, especially the cold winters of 1939/40 and 1941/42 when the absolute minimal temperature dropped to −41 °C (Prilipko, 1982) and many introduced trees perished.

Comparison of the number of trees and species composition in the subject area showed that most of the trees belonged to our indigenous broad-leaved species. This can be explained by their higher resistance in the urban environment compared to introduced species and by the fact that it was common to use mainly natural trees when green areas were established. On the other hand, it also became clear that the percentage of introduced trees is rather high – 41.9% (10 006 trees), among which are fruit trees (1935 trees), especially apple trees. The latter accounted for 92.3% of the overall number of fruit trees and demonstrated the greatest spread in the Kalamaja district – 27.0% of all the trees.

Among the city districts Mustamäe had the lowest number of introduced trees – 874 (23.8%) – because the former greeneries with indigenous trees were preserved during the construction works and more indigenous trees were used compared to other districts when establishing new greeneries. The share of introduced trees was the highest in the Kalamaja district – 56.3% (2903 trees).

The most widespread native tree species are *Betula pendula* Roth (3581 trees), *Acer platanoides* L. (2997 trees), and *Fraxinus excelsior* L. (1013 trees), and the most widespread introduced species are *Tilia* × *europea* L. (2354 trees), *Malus domestica* Borkh. (1737 trees), and *Aesculus hippocastanum* L. (1134 trees). Five indigenous and four introduced species (over 3% of the total number of trees) made up 40.3% (9660 trees) and 24.9% (5962 trees) of all trees, respectively. The total number of trees belonging to these nine species was 15 622 (65.1%) (Fig. 3).

A total of 8365 trees of 131 taxa belonged to occasional (seldom cultivated and recently adopted species) and rare species (less than 10 specimens).

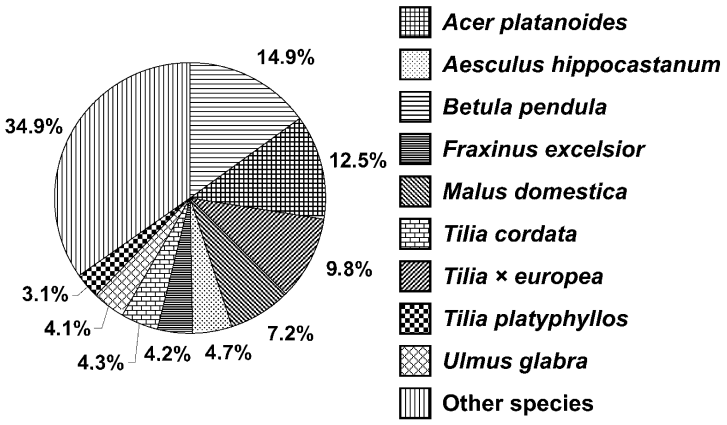

Fig. 3. Composition of tree species (3% or more) in Tallinn.

The percentage of the most common trees was different in the studied areas. It appeared that 12 tree species had a spread of 5% and more (Fig. 4), of which 7 species (share 10% or more) were the dominant and co-dominant species among the woody plants in all the different areas. Among the 12 most widely spread species 8 were native – *Picea abies*, *Acer platanoides*, *Alnus glutinosa* (L.) Gaertn., *Betula pendula*, *Fraxinus excelsior*, *Sorbus aucuparia* L., *Tilia cordata* Mill., and *Ulmus glabra* Huds. – and 4 were introduced species – *Aesculus hippocastanum*, *Malus domestica*, *Tilia* × *europea*, and *T. platyphyllos* Scop.

Rare trees

Based on the occurrence of taxa, number of specimens, dimensions, and other factors 142 rare trees from 70 taxa (14.6% of the tree taxa of Tallinn) were recorded. Of these 77 specimens belonged to 28 species, 3 were hybrids, 1 was a variety, and 2 forms and 65 specimens (45.8%) belonged to 36 cultivars. Twenty rare trees from 13 taxa were younger than 50 years, 51 trees (14 taxa) were 50–65 years, 41 trees (23 taxa) were 65–85 years old, and 30 trees (20 taxa) were older than 85 years. The oldest rare trees were a specimen of *Ginkgo biloba* L. of about 120 years of age, four specimens of *Salix alba* L. 'Britzensis', three specimens of *Acer saccharinum* L. and one specimen of *Aesculus hippocastanum* 'Pendula', *A.* × *hybrida* DC., *Corylos colurna* L., *Quercus robur* L. 'Cucullata', *Salix fragilis* L. 'Bullata' were over 100 years of age. These trees originate from the gardens and parks of the 19th century. The *Ginkgo biloba* specimen is also the rarest tree in Estonia (Sander, 1999). Its value is especially high because on the global scale the age and the measurements of this tree are unique on such a high latitude.

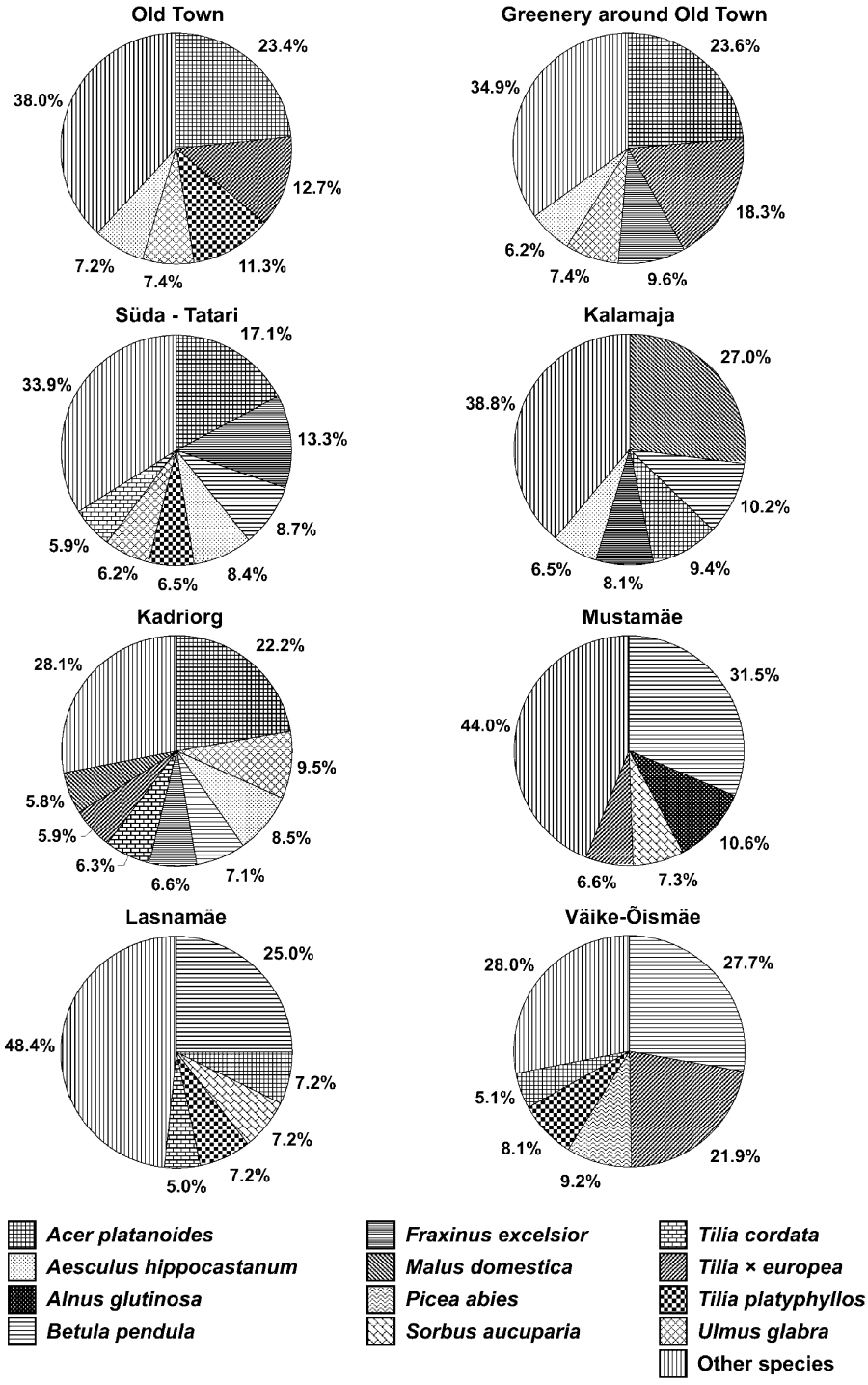

Fig. 4. Composition of tree species (5% or more) in eight areas of Tallinn.

Furthermore, the tree is also important historically (a remnant of one of the most renowned gardens in Tallinn), and by personal associations (probably planted by Wilhem Kühnert (1819–1891), a prominent head forester in Estonian forestry). We regard this tree as unique in Tallinn (Annuka et al., 1985; Sander & Meikar, 1996; Sander, 1999).

Age of trees

The oldest trees in Tallinn grow on the Kopli Peninsula (in the northen part of the city), in the city centre, in the Kadriorg park (in the eastern part of the city, founded in 1718), in the old suburbs, and in the parks of summer manors (Künnapuu, 1975; Šestakov & Tamm, 1986; Tamm, 1988; Sander, 1998; Läänelaid et al., 2001).

The oldest specimens in Tallinn, whose age extends to 300 years or even more, belong to the following three species: *Quercus robur* L., *Tilia cordata*, and *T.* × *europea*. *Pinus sylvestris* L. and *Populus nigra* L. are represented by specimens of the age of 200–300 years.

The number of taxa with the oldest specimens of 100–200 years of age is 34. Among them there are 6 native species (*Picea abies* (L.) Karst., *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus excelsior*, *Ulmus glabra*) and at least 28 foreign taxa: *Ginkgo biloba*, *Larix deciduas* Mill., *L. sibirica* Ledeb., *L.* × *eurolepis* Henry, *Pinus cembra* L., *P. nigra* Arnold, *P. strobus* L., *Pseudotsuga menziesii* (Mirb.) Franco, *Thuja occidentalis* L., *Acer platanoides* 'Schwedleri', *A. pseudoplatanus* L., *A. saccharinum*, *Aesculus hippocastanum* and its cultivar 'Pendula', *A.* × *hybrida*, *Fagus sylvatica* L. and its cultivar 'Atropunicea', *Populus* × *canadensis* Moench 'Eugenei', 'Marilandica' and 'Serotina', *P.* × *canescens* (Ait.) Sm., *Quercus rubra* L., *Q. robur* 'Cucullata', *Salix alba* 'Britzensis', *S. alba* L. var. *sericea* Gaudin, *S. fragilis* 'Bullata', *S.* × *rubens* Schrank, and *Tilia platyphyllos*.

Ninety taxa are represented by 60–100 year-old specimens. Among them were for example (species and varieties of rare exotic trees) *Abies concolar* (Gord et Glend) Lindl. ex Hildebr., *A. veitchii* Lindl., *Chamaecyparis pisifera* (Sieb. et Zucc.) Endl. 'Filifera', 'Plumosa', 'Plumosa Aurea', *Juniperus virginiana* L., *Larix decidua* 'Pendula', *L. kaempferi* (Lamb.) Carr., *Picea abies* 'Tuberculata', *Pinus strobus* L., *Thuja occidentalis* 'Filicoides' and 'Lutea', *T. plicata* Donn ex D. Don, *Tsuga canadense* (*L.*) Carr., *T. diversifolia* (Maxim.) Mast., *Acer platanoides* 'Cucullatum', 'Dissectum', 'Globosum', 'Oekonomierat Stoll', and 'Schwedleri', *A. pseudoplatanus* 'Leopoldii', *A. saccharinum* 'Wieri', *Aesculus* × *carnea* Hayne, *A. glabra* Willd., *A. hippocastanum* 'Albovariegata', *A. flava* Soland., *Betula payrifera* Marsh., *Carpinus betulus* L., *Corulus colurna*, *Fraxinus pennsylvanica* Marsh. 'Aucubifolia' and 'Variegata', *Juglans cinerea* L., *J. ailantifolia* Carr. var. *cordiformis* (Mak.) Rehd., *Phellodendron amurense* Rupr., *Populus simonii* Carr. and its cultivar 'Fastigiata', *Pterocarya fraxinifolia* (Lam.) Spach, *Quercus robur* 'Fastigiata' and 'Pendula', *Robinia pseudoacacia* L., *Tilia platyphyllos* 'Aurea'

and ‘Rubra’, *Ulmus glabra* ‘Crispa’ and ‘Lutescens’, *U. minor* Mill. ‘Hoersholm’, *U. procera* Salisb. ‘Purpurea’, etc.

The overwhelming part of the taxa of the trees registered by us (351 taxa, for example *Chamaecyparis lawsoniana* (A. Murr) Parl. ‘Glauca’, *C. nootkatensis* (D. Don) Spach ‘Glauca’, *Larix decidua* × *L. sibirica*, *L. gmelinii* (Rupr.) Kuzen., *L. gmelinii* (Rupr.) Kuzen. var. *japonica* (Regel) Pilger × *L. kaempferi* (Lamb.) Carr., *L. kaempferi* and its cultivar ‘Pendula’, *Picea abies* ‘Lubecensis’, *Pinus sylvestris* ‘Fastigiata’, *Aesculus hippocastanum* ‘Baumannii’ and ‘Memmingeri’, *Populus alba* L. ‘Pyramidalis’, *Prunus armeniaca* L., *P. maacki* Rupr., *P. mahaleb* L., *Populus suaveolens* Fish. × *P. laurifolia* Ledeb.) consists of specimens under 60 years of age. Approximately one third of these are specimens aged under 15 years.

In the Middle Ages, the Kopli Peninsula was known for its oak grove with ancient trees. As late as in the 19th century, Russow (1862) wrote in his treatise on the flora of Tallinn that “colossal” oaks were growing at Kopli. The probable age of the four biggest oaks in Kopli in 1999 calculated both by tree-rings and the bark method was (1) 350 and 375, (2) 350 and 250–280, (3) 340 and 270–300, and (4) 320 and 210–230 years.

In the Kadriorg park the age of 12 oaks was calculated. The ring method showed that the age of 11 oaks was 250–350 years. Among the 12 trees the age of 7 oaks was 260–330 years according to the bark method, thus many trees are older than the park. The oldest trees in the park may be of natural origin.

The age of the oldest oak in the centre of Tallinn is 250 or 190–220 years. This tree grows on the territory of a former summer manor (13 Toomkuninga Street).

The largest concentration of old limetrees is in the city centre. There they grow on the former bastions and by the Cathedral Church and Niguliste Church, as well as individually in old courtyards.

The stems of the limes growing on the bastions and near the churches are knotted and hollow. So it is very difficult to identify their age. Howewer, the age of nine trees growing on the bastions of Skåne and Ingermanland was determined by the tree-ring method in 1999. The calculated age of seven trees was 223–275 and that of three trees 300, 358, and 390 years. Unfortunately, there is no historical evidence about the ages of 358 and 390 years.

On the Skåne bastion the calculated age of four trees planted at the same time was 223–275 years (average 250). The age of the two oldest trees was 300 and 390 years. It might be that the two older trees on the Skåne bastion were represented on the city plan dating back to 1728. The plans show that 19 or 20 trees were planted on the Skåne bastion. Zobel (2001) agrees that the trees on the Skåne bastion were planted at the end of the 17th or the beginning of the 18th century during the Swedish period.

In 1710–21 the Skåne bastion was strengthened. Between 1750 and 1790, construction works in the bastions were carried out (Kenkmaa & Vilbaste, 1965; Zobel, 1994, 2001). So, the younger six trees of the Skåne and Ingermanland

bastions were planted in the period 1750–90. Unfortunately, there are no data available about the planting of the trees.

The oldest introduced limetrees in Tallinn are *T.* × *europea*, which stand by the Niguliste Church. The age of one of them calculated by the bark method is 340 years. The age of the other lime calculated from the rings is 276 years. This tree grows in the former cemetery of the Niguliste Church. The older tree is known as the Lime of Kelch. Its indicated planting time is 1680 (Sander, 1998). Under this tree Christian Kelch (born 1657), the famous chronicler and the pastor of the Niguliste Church, was reportedly buried on 13 December 1710 (Viirok, 1932).

A *T. cordata* by the Cathedral Church was investigated both by the method of the tree-rings and the bark. The calculated age of this tree is 214 and 280 years, respectively. Trees near the Cathedral have obviously been planted after 1684 when the buildings on Toompea Hill perished in fire and after that were mostly demolished. The fortification plan from 1728 shows numerous trees at the Cathedral Church.

The best overview of the trees growing in the city centre in the early 19th century is given by the city plan of the year 1825 prepared by Üprus (1965). The plan shows a large number of private and church gardens and trees on the bastions and one Town Park (founded in 1822).

One of the oldest trees in the city is also a *T. cordata* growing at Kose, on the territory of the erstwhile Carlshof summer manor, in front of the main building (erected in 1785) at the crossing of Vabaõhukooli and Kose streets.

A *Populus nigra* growing by the Kaasan Church, known as the Poplar of Peter I, is also considered to be older than 200 years (Viirok, 1932; Künnapuu, 1975).

Dimensions of trees

Many trees of a number of the more widely spread species are conspicuous in the city environment due to their advanced age and large dimensions. Here they are regarded as great, superb, hereditary, elite, or champion trees (Jim, 1994).

As tree dimensions are related to their age, the highest trees in Tallinn, which also have the thickest stems, grow in old parks, former bastions, and suburbs. The dimensions of trees are determined by their height and thickness. Occasionally, the product of the height of trees multiplied by their thickness has also been used as a measure of dimension.

The three species with the highest specimens reaching 30–35 m are probably native forest trees *Pinus sylvestris* and *Picea abies* and introduced trees *P.* × *berolinensis* K. Koch. The highest alien tree in Tallinn is a *P.* × *berolinensis* – 31.8 m (perimeter 390 cm, 2000). It is growing in the courtyard of 23 Sakala Street (Relve, 2000).

The following ten species shoot their largest specimens up to 25–30 m: *Larix decidua*, *L. sibirica*, *Betula pendula*, *Aesculus hippocastanum*, *Fraxinus excelsior*, *Populus* × *canadensis*, *Populus* 'Petrowskiana', *Tilia cordata*, *T.* × *europea*, and

Ulmus glabra. The species with the highest specimens reaching 20–25 m belong to 25 taxa. The number of taxa whose largest specimens rise to the height of 10–20 m is 105. The overwhelming majority of the 337 tree taxa we have registered is represented by specimens with the height of less than 10 m. Of these, about 1/3 belong to taxa whose largest specimens remain under 5 m in height.

There are also trees in Tallinn that are conspicuous for the thickness of their stem. We have registered about 800 trees with the perimeter of 300 cm and more. These trees belong to eleven genera: *Larix*, *Pinus*, *Acer*, *Aesculus*, *Alnus*, *Fraxinus*, *Populus*, *Quercus*, *Salix*, *Tilia*, and *Ulmus*. Trees of this thickness were registered among 20 species. The greatest trees of Tallinn (thickness measured as chest perimeter exceeding 500 cm) come from eight species (*Populus* × *berolinensis*, *P.* × *canadense*, *P. nigra*, *Quercus robur*, *Salix alba*, *S.* × *rubens*, *Tilia cordata*, and *T.* × *europea*).

DISCUSSION

The diversity of woody plants in cities is a result of human activity. It also depends on climatic factors, the percentage of natural plants (forests), vegetation traditions, the planting material used, the financial resources of organizations, etc.

Trees are in many ways the antithesis of urbanization. As surrogate and fragments of nature, they are earnestly desired yet paradoxically so gravely deficient in cities (Jim, 1994).

Tallinn is characterized by a rather high diversity of tree species – out of the 1275 woody plant taxa, 480 are represented by specimens that could be defined as growth forms of trees. A comparison of the taxonomic composition of trees showed that various cultivars were predominant. However, a fairly great number of species could also be observed, even if consisting of relatively rare taxa represented by solitary specimens. The richness of species and the rarity and number of cultivars of trees in Tallinn are ascribable to the fact that the majority of the taxa involved are situated in ornamental gardens and woody plants collections.

The most widely spread trees over the whole city can be obtained from the database of urban forests and biomass (Rauk & Saar, 1986; Pärn, 1990).

The most widespread forest tree species in Tallinn (in urban, suburban, and periurban areas) is *Pinus sylvestris* (Rauk & Saar, 1986; Pärn, 1990; Sander et al., 1996). The stands of pine trees predominating (pine groves) make up 75% (1740 ha) of the total of the city forests (2321 ha) and 10.5% of the city territory. Of the phytomass of woody plants (189 510 dry matter tonnes), *Pinus* spp. constitute 64% (121 286 tonnes). Pines account for 49% (77 200 dry matter tonnes) of the urban and suburban area biomass and 75% (112 310 dry matter tonnes) of the periurban area biomass.

Pinus sylvestris is followed by *Betula pendula* and *B. pubescens* and *Alnus glutinosa* and *A. incana*, constituting 14.0% (324 ha) and 4.1% (96 ha) of the city

forests, respectively. However, based on phytomass, the share of *Betula* spp. and *Alnus* spp. reaches 12% (22 741 tonnes) and 6% (11 370 tonnes), respectively.

Based on phytomass of woody plants, in urban and suburban areas *Pinus sylvestris* is followed by *Betula* spp. – 13%, *Eupopulus–Populus* spp. and *Acer* spp., both genera make up 7% each, and *Tilia* spp. – 6%. However, the share of foreign species of the genera *Pinus*, *Betula*, and *Acer* in the phytomass is practically zero (Rauk & Saar, 1986; Sander et al., 1996).

On the basis of data of five cemeteries of Tallinn (Kopli, Kalamaja, Siselinna, Pirita, and Pirita Nunnery) with the area of 35.6 ha and phytomass of woody plants 4.480 dry matter tonnes, the genera *Acer*, *Tilia*, *Fraxinus*, *Aesculus*, and *Ulmus* had the highest frequency and phytomass (Rauk et al., 1991).

It was detected during the analysis of the green belt surrounding the Old Town and seven districts of Tallinn (in the urban and suburban areas) that five native species (*Acer platanoides*, *Betula pendula*, *Fraxinus excelsior*, *Tilia cordata*, *Ulmus glabra*) and four introduced species (*T.* × *europea*, *Malus domestica*, *Aesculus hippocastanum*, *T. platyphyllos*) were the most widely spread. The above species are the most common in most North European cities, especially in the areas close to Estonia. Dutch and large-leaved lime, which are better adjusted to the urban environment, are numerous. For excample, the dominant species in Lithuanian towns are *Tilia* species – *Tilia cordata*, *T.* × *europea*, *T. plathyphyllos* (80%), followed by *Aesculus hippocastanum* (20%), *Acer* spp. (*Acer negundo*, *A. platanoides*) (Juronis & Snieškiene, 2001). The most common species in the green areas of Riga are four native species: *Tilia cordata* – 58 sites (76.3%), *Acer platanoides* – 54 sites (71.1%), *Betula pendula* – 52 sites (68.4%), and *Quercus robur* – 47 sites (61.8%), as well as two introduced species: *Tilia* × *europea* – 60 sites (78.9%) and *Aesculus hippocastanum* – 50 sites (65.8%) (Pūka et al., 1988).

The study revealed that based on the incidence of trees, as well as their age and measurements, we may classify 140 specimens from 68 taxa as rare in Tallinn. The oldest rare trees suggest a high-level horticultural tradition and a well-planned selection of tree species in the then Tallinn. Twenty species and varieties of old (more than 60 years) exotic trees are extremely valuable, since they have proved to be resistant to the prevalent climatic conditions, habitat destruction, environmental degradation and human pressure. The most prominent case appeared to be that of the ginkgo tree (*Ginkgo biloba*).

The larger and more mature trees have the greatest impact on their environment. As living heritage, the old trees should be equated with the historical monuments of the city and designated for special preservation by amending the existing Antiquities and Monuments Ordinance. In the case of privately owned champion trees, consideration should be given to the allocation of public funds as subsidies for tree maintenance (Jim, 1994; Nelson, 1994).

Analysis of tree age and dimensions revealed that Tallinn is characterized by the existence of old trees aged almost or more than 300 years, as well as the occurrence of trees of fairly remarkable dimensions (in height and perimeter).

Consequently, a number of old *Quercus* and *Tilia* in Tallinn are valuable not only for this city but also for Europe as a whole, and we must make every effort to preserve them. The outstanding gallery of rare and old trees provides us with important arboricultural and environmental information and raises the awareness of the community through publicity and educational means.

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Tallinna linnapuud

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On käsitletud Tallinnas kasvavate puude liigirikkust, haruldasi puid, puude vanust ja mõõtmeid. Senini on Tallinnas registreeritud 1275 taksonit kodu- ja võõramaiseid puittaimi, millest 480 taksonit on vaadeldavad puude eluvormina.

Viimastest 140 taksonit on okas- ja 340 taksonit lehtpuud. Enama levikuga on mitmesugused kultivarid – 284 taksonit, neile järgnevad juba 153 liiki.

Hoonestatud ala kuue uuritud piirkonna alusel leiti, et levinuimad puuliigid on arukask (*Betula pendula*), harilik vaher (*Acer platanoides*), harilik saar (*Fraxinus excelsior*) ja lääne pärn (*Tilia* × *europea*). Puuliikide leviku, vanuse, mõõtmete ja teiste tegurite põhjal selgus, et 142 puud 70 taksonist on Tallinnas haruldased. Neist 71 puud 43 taksonist on vanemad kui 60 aastat.

Iga taksoni suurima isendi vanuse ja kõrguse alusel selgitati vastavad suurusjärgud. Leiti, et taksoneid, mille suuremate isendite vanus on 200–300 või enam aastat, on 5, 100–200 aasta vanuseid on 34 ja 60–100-aastasi 90. Taksoneid, mille suurimate isendite kõrgus on 30–35 m, on 3, 20–30 m kõrgusi 35 ja 10–20-meetriseid 105. Puude jämeduse alusel on registreeritud peaaegu 800 puud 11 taksonist, mille rinnasümbermõõt on 300 ja enam sentimeetrit. Puid rinnasümbermõõduga 500 ja enam sentimeetrit on kaheksast liigist.