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CURLY BIRCH STANDS AND CULTIVATION RESULTS IN ESTONIA

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Abstract. Curly birch (*Betula pendula* var. *carelica*) is one of the most peculiar and rarest trees in the whole of North and Central Europe. In Estonia the species occurs in natural conditions, mainly in West, North-West and North Estonia, as well as on maritime islands. As to forms of its growth and stem, it may have the shape of a bush or a low tree. On its trunk and branches there are characteristic bumps or swellings. Due to this valuable timber and beautiful texture but also its rare existence in nature, the curly birch is worth growing in plantations. During recent decades there are thousands hectares of abandoned agricultural grasslands, pastures and fields that will naturally regenerate with deciduous trees having little value in Estonian timber market. In these areas is reasonable to cultivate curly birch.

The first experimental plantations of the curly birch were started in 1970s. After the foundation of Estonian Curly Birch Society in 2000 both a good knowledge of the species and the number of curly birch artificial stands grew immensely.

According to the questionnaire approximately 250–500 ha of curly birch plantations, which are scattered all over Estonia, have been started during the recent decade.

Introduction. The curly birch (*Betula pendula* Roth var. *carelica*) ((Mercklin) Hämet-Ahti 1984) is quite rarity tree species in the world. Curly birch usually grows in small numbers in different places either as a single tree or a group in the stands of some other species. The curly birch does not form pure stands as a rule. The habitat of the curly birch is mainly the region of the Baltic Sea and Central Europe. It is a common species in the North West of Russia (Karelia), in the east of Finland and in Byelorussia. To a lesser extent, it can be met in Estonia, Latvia, Sweden and Norway [15, 3]. A few single trees have been found also in Lithuania, Slovakia and the Czech Republic [14, 9]. The species occurs naturally in the West, North-West and North of Estonia and on maritime islands [7, 10].

The curly birch is not demanding, being able to grow in the soils of different fertility. In Estonia it is naturally more common in *rendzic, skeletic* and *calcaric* soils, but can also grow in sandy or swampy soils, where it grows in sparsely stocked stands or at their edges. It can be met in wooded meadows, former pasturelands, gravelly beach ridges, near some stone fences, etc. The thing is that the species cannot rival with fast-growing deciduous trees in more fertile sites, being dominated by them and thus, perishing due to the shortage of sunlight in their shade [7, 10, 11].

Although for centuries already the curly birch has been well-known in Estonia for its hard timber and its unrepeatably beautiful texture, the first written records of its existence in Saaremaa and South East of Estonia (near Petseri) date back only to the 1930s [1].

In fact, there is no reliable data about the sites of the curly birch in Estonia before 1970, as the species was often not identified in the nature or it was considered so rare that no one actually tried to find the sites of the tree. Basically it happened only in1970s that the most important sites of the curly birch were recorded and mapped [6, 2, 7]. Unfortunately in 1980s the activities stopped again and only very few scientists and nature lovers took interest in the species as a hobby. Still, by the beginning of 1980s different researchers and nature lovers had counted more than 600 curly birches growing in natural conditions [7, 8]. However, a re-inventory control taken at the very beginning of the 21st century showed that the number of

the sites described in 1980s had either substantially decreased or the trees had not existed at all, as only approximately 100 trees were found in the course of the re-inventory.

Between 1950 and 1970 numerous curly birches in Estonia were destroyed due to ignorance. During the period they were often cut in the process of improvement fellings, as they were considered silver birches. Those trees looked crooked, overtopped and non-viable and they were cut and burnt as firewood. In 1980s and 1990s things changed and some people deliberately started looking for the most valuable curly birches (having the shape of a tree). So, a major part of the most valuable trees were destroyed during those spontaneous rapacious selective cuttings [12].

In September 2000 Estonian Curly Birch Society (*Maarjakase Selts*) was founded in Tartu to protect the existing natural sites of the curly birch and to preserve the gene pool of the survived trees, also to foster the research and cultivation of the species [12].

In 1920 the first artificial curly birch stand in the world was planted by V.T. Aaltonen in Evo, Finland. Under the supervision of Professor Heikinheimon a 20-hectare experimental curly birch plantation was created in the same area in1930s [4, 3]. In 1934 the first artificial stands were founded by N. Sokolov at Tcharevitch in Russia [16]. In 1936 the first four curly birches (transplants imported from Finland) were planted at Paukjärve not far from Aegviidu in Estonia [6, 5, 7].

The first curly birch seeds (also imported from Finland) were sown in the Institute of Experimental Biology at Harku in 1957. The plants grown from the seed were used in alleys and some arboretums, no artificial stands were started at the time. Approximately 50 trees were planted along some alleys in Tartu, which are still there. A minor part of those young trees found their place in Tallinn Botanical Gardens, where most of them have unfortunately perished. In 1970s a few experimental curly birch plantations were created all over Estonia, most of which do not exist any more because nobody tended to them later [5].

Thanks to the activities of Estonian Curly Birch Society in promoting cultivation of the curly birch and owing to the great amount of (not very fertile) agricultural land abandoned in 1990s, all over Estonia at the beginning of the 21st century, the curly birch was planted in some areas of former arable land, which had already started to be overgrown with bushes [10].

The aim of the present paper is to find out about the approximate area of the curly birch plantations in Estonia, their location, the quality and origin of the planting stock, how the trees had started growing, occurrence of some damage and other possible problems concerning the foundation and management of curly birch plantations.

Material and methods. The research is based on a written questionnaire, which consisted of 32 multiple choice questions, conducted between 2008 and 2009. The questionnaire was sent to 107 persons all involved with cultivating the curly birch in Estonia, which is approximately two thirds of all the people who have started that kind of plantations. The questionnaires were sent either by post or by e-mail. The statistics software program SPSS 17,0 (www.spss.com) was used to process the data obtained from the questionnaires. Statistical analyses were carried out by MS Excel and statistical program SAS.

Results and discussion. The 107 questionnaires were responded to, but only 65 questionnaires were used in the analysis of the obtained data. It appears that people of all age groups (between ages 21 and 80) have taken up the foundation and management of curly birch plantations. The majority of the respondents have either higher or vocational education.

The curly birch plantations are located quite evenly all over Estonia. However, the greatest number can be found in Southern and Central Estonia, which is probably so due to the existence of the large areas of abandoned agricultural land in these regions. The numbers of founded plantations throughout the years are presented in Fig. 1. The biggest number of curly birch stands were founded in 2005, the smallest number in the years 1995 and 1999. According to the responses, no plantations were created between 1996 and 1998. Both plants grown from the seed and meristems have equally been used to start the artificial stands. There have been quite few cases when the methods of grafting and budding were used.

Two- or one-year-old plants were used to start the stands the most often (49 % and 29 % respectively), three or four-year-old plants were used more seldom. The average price of a young curly birch had been 0,5 euros, a meristem plant cost 0,78 euros and a plant grown from seed 0,32 euros on an average. About a third of the plantation owners (35 %) had an opportunity to partly use European Union

funding. Most of the artificial stands had been started in former arable lands (49 %) or meadows (43 %). Woodlands and other types of cultivable land holdings were used much more rarely.

As for management procedures, 77 % of the respondents mentioned cutting grass as the most common activity, 48 % had trampled down the grass around trees, 60 % of the owners had cut branches and done some green pruning. Practically nothing had been done to prevent game damage and other types of damage [13]. Only 26 % of the respondents had built chain-link fences, quite few (22 %) had used smell repellents (Plantskydd Animal Repellent) to prevent damage caused by ungulates, some forms of stem protection (12 %) or insecticides (9 %). The proportion of insect and mammal damage in the curly birch plantations has been shown in Fig. 2.

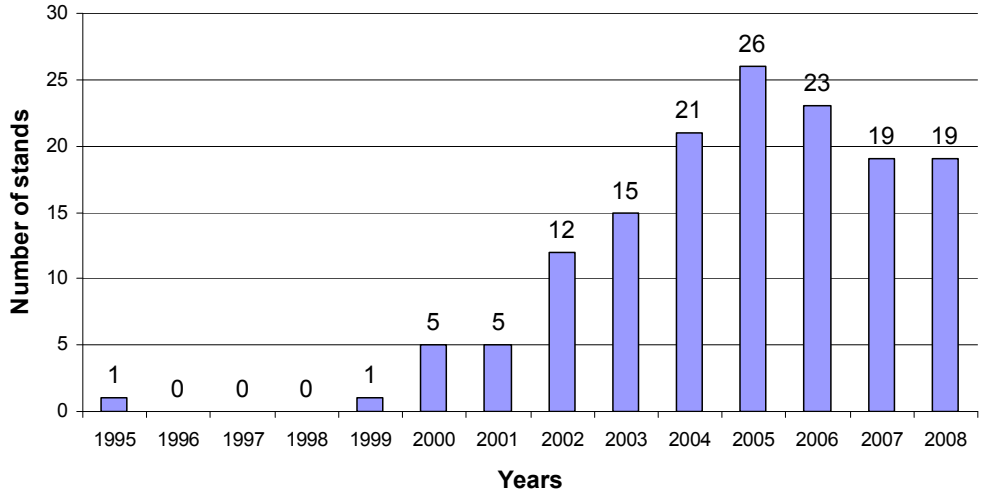

Figure 1. The number of cultivated curly birch stands in Estonia in the years 1995–2008.

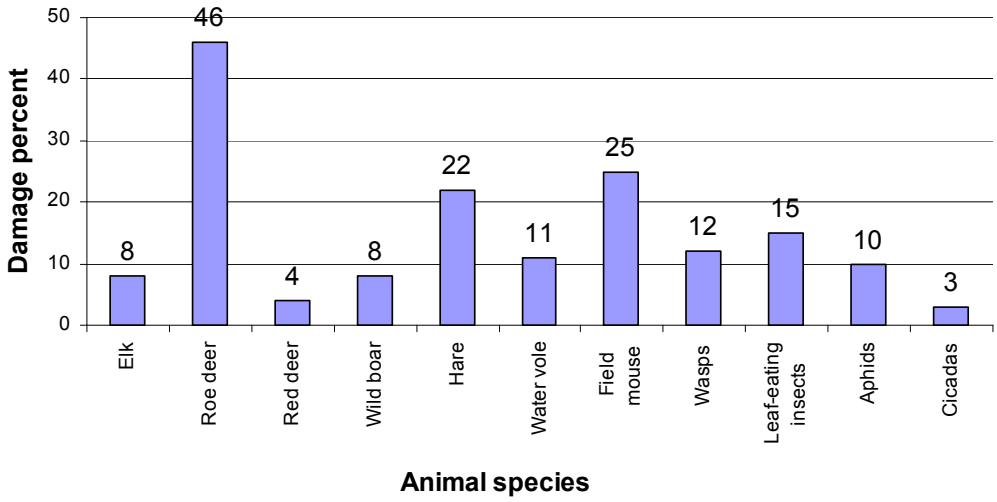

Figure 2. The proportion of animals caused damage in cultivated curly birch stands.

Conclusions. The curly birch occurs in natural conditions mainly in the West, North-West and North of Estonia as well as on maritime islands. The number of trees growing in nature has decreased as a result of ignorance and destructive felling. The first experimental plantations of the curly birch were started in 1970s. After the foundation of Estonian Curly Birch Society in 2000 both a good knowledge of the species and the number of curly birch artificial stands grew immensely.

The aim of the research was, by means of a questionnaire, to find out about some problems concerning the foundation and management of curly birch plantations created in Estonia during the recent decade. Another aim was to obtain some measurement data, e.g. the average height of the trees, root collar diameter etc.

According to the questionnaire approximately 250–500 ha of curly birch plantations, which are scattered all over Estonia, have been started during the recent decade. The highest number of curly birch artificial stands were founded in 2005: 29 plantations. The average area of a plantation was 2,37 ha. The smallest curly birch plantation covers only 0,05 ha, whereas the largest curly birch artificial stand (53 ha), situated in Northern Estonia (Harjumaa), is also the biggest in Europe according to the information available to us. Approximately half (47 %) of the plantation owners want to increase the area of their stands. Most of the plantations have been founded in former cultivable land, mainly fields and meadows. Much less former woodland has been used for the purpose. 2-year-old curly birch seedlings or meristems, grown in Estonia, (55 % and 45 % respectively) have been used for planting the most often. 41 natural or legal persons are involved with growing the planting stock. According to our data nearly one million young trees have been used to start curly birch plantations or add to the existing ones. Nowadays practically no plants have been imported, whereas approximately 0,7 million young curly birches have been exported, mostly to Finland.

Most of the trees have been planted using a spade (80 %), only in a few cases a planting hatchet or tube have been used. The average planting density in the stands has been 1641 trees per hectare.

The average tree distance in the rows is 2,6 m and the average distance between the rows 2,8 m.

The average tree height in the stands is 1,8 m, but in the oldest plantations it is 5,3 m, whereas in the youngest stands the average tree height was 0,4–0,6 m.

Regarding management, the most common activities have been cutting grass and trampling down the grass around trees, also cutting branches, green pruning, watering and mulching. Fertilizing and chemical weed control have been the least common methods. According to the questionnaire preventing game and insect damage in the plantations have been the most problematic.

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