

Скорость фотосинтеза в процессе адаптации и роста возростала, в то время как затраты на темновое дыхание оставались неизменными, и только изменение режима выращивания (перемещение в теплицу) вызывало увеличение скорости фотосинтеза с одновременным увеличением скорости дыхания. Это перемещение не было благоприятным, о чем свидетельствует снижение отношения скорости фотосинтеза к дыханию. Какой из параметров условий выращивания (температура, влажность воздуха и субстрата, освещенность) оказался неблагоприятным (или их совокупность) предстоит еще выяснить.

Вышеизложенные результаты позволяют заключить, что ИОС являются пригодными для адаптации и выращивания микроклональных регенерантов карельской березы разных форм. Они позволяют круглогодично получать качественный посадочный материал для высадки в открытый грунт с высокой степенью приживаемости.

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PRESENT VALUE AND PERSPECTIVE OF THE CURLY BIRCH GROWING IN SLOVAKIA

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Abstract. In Slovakia curly birch belongs among rare woody plants. A detailed study of curly birch distribution and variability was done in 1981–1985. At present 330 the most valuable clones of the various growth forms are archived in the clone archive and in arboretum collection. Concentration of such large diversity of the growth forms and curly birch genotypes provides good conditions for basic research of

curly birch and gives opportunity for applied research. The main task is production of tree form hybrids with good growth characteristics and decorative timber. In Slovakia curly birch can be planted within forest and non-forest plantations mainly on abandoned agricultural land on stands with reachable terrain. Future research will be focused on seed quality from the seed orchard of curly birch and assessment of inheritance of the decorative timber in half-sib progenies

Introduction. Birch is a pioneer woody plant in Slovakia distributed all over the cultural landscape and also in woodlands. Abandoned stands are often colonized with pioneer plants including birch. Birch is a typical light-demanding woody plant with dynamic growth and development. On many stands is therefore very competitive against other woody plant species. Regenerates quickly on clear-cuts or calamity stands and expands also on stands of the managed forests.

Therefore birch is very competitive to other climax woody plants and for many years was regarded to be «unacceptable» on forest stands. Within silvicultural practice was mostly removed from forest stands. On the other hand, birch timber production probably reached significant amount within the country, because often grows in larger groups or creates small crops on non-forest land and abandoned agricultural or devastated stands. However, there was lack of knowledge about productivity and intraspecific variability of this taxon. In 1976–1980 was done a detailed study of distribution and intraspecific variability of *Betula alba* L. in Slovakia.

The distribution of birch taxa in Slovakia is illustrated on Figure. Territory with low occurrence of birch taxa represents main lowlands on Slovak territory (Danube lowland and south-east part of the East Slovak lowland). These regions represent the main agricultural regions of the country and are influenced by intensive human activity. Woodlands represent floodplain communities of willows, poplars and floodplain oak forests. Birch appears at higher altitudes on uplands and mountain regions of Slovakia, where grows in the forests or within the scattered non-forest vegetation. Among 214 experimental plots established for study of the birch population variability and growth rate, curly birch was found on 78 [6]. The distribution of curly birch is documented just in the north-west and north-east parts of the country (Fig.). Curly birch occurrence was not confirmed in the central part of the country, where is missing probably in consequence of the large complex of forest stands with shading and semi-shading woody plants (*Fagus sylvatica*, *Abies alba* and *Picea abies*).

According to field study, distribution of birch was confirmed in all orographic units and forest vegetation stages of Slovak republic. Study documented presence of several technical forms with valuable timber within birch populations [4]. Distribution and intraspecific variability of technical forms of birch with special attention on curly birch were analysed 1980–1985. There were found following forms of birch: birds-eye, curly and dark bark [5]. Individuals with curly grain texture of timber had the highest rate within identified birch forms. However, their quality was sometime negatively influenced by human activity (girdling and pruning).

Several growth forms of curly birch were identified – tree forms with various types of bulges, low-stem forms, shrub forms and multi-stem forms. The highest number of analysed individuals was classified according to classification of Ljubavskaja [3] as **IIa** low-stem form of curly birch with globular bulges on stem and branches. Quite abundant was also tree form **IIb** with massive globular bulges. Smaller rate within studied populations had individuals of tree form **Ia** with delicate and regular curly grain on the stem. Very frequent were shrub forms **III**.

In Slovakia was found also a tree form of curly birch with dark bark, such individuals appeared on 9 localities. One individual growing in the forest crop had ring-shaped regular curls on the stem. Tree was 17 m high with diameter at breast height 0,4 m [6].

Growth characteristics of analysed curly birch individuals in Slovakia were lower, than data given by other authors [2, 1, 3] and are probably influenced by age. Mostly there were young plants growing out of the forest crops. The most frequent heights were 10–11 m with diameter 0,16–0,22 m. The average height of all analysed tree forms 6–7 m with average diameter between 0,10–0,11 m. Age structure of curly birch populations was influenced by human activity on non-forest land, where birches were intensively harvested and pruned.

Present value of curly birch gene pool in Slovakia. The most valuable forms were included under project of the gene-pool preservation of curly birch in Slovakia. About 330 individuals with good growth characteristics (tree forms) and regular curls (low stem forms and shrub forms) were grafted on rootstocks of silver birch (*Betula pendula*). Average survival of the grafts reproduced within three years was about 64 % and strongly varied between particular clones from 18 %–100 %.

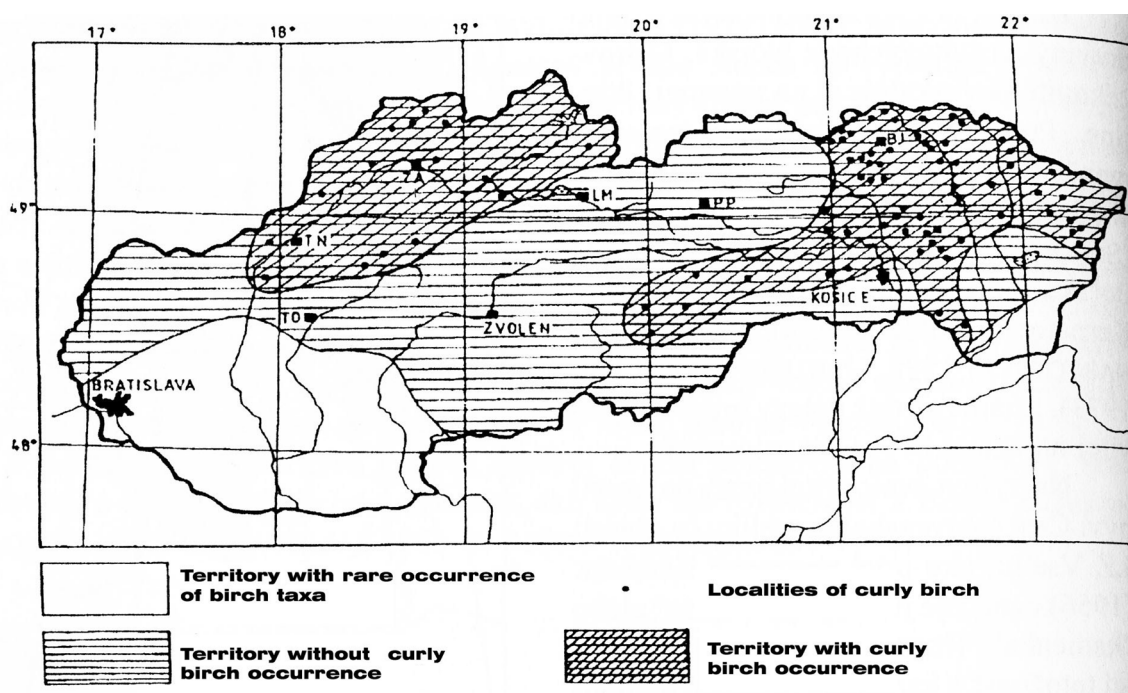


Figure 3. Distribution of birch taxa in Slovak Republic according to field study (Pagan et al., 1985)

In 1982 the majority of obtained clones (304) were planted in the clone archive at the altitude 600 m on locality Kašova Lehôtka – upland sunny stand with south-west exposure. Each clone is represented by five grafts. In the clone archive were planted all growth forms of curly birch from Slovakia with various types of curls on the stem. A higher number of planted clones represent extraordinary or rare types of curly birch with black bark, or bundles of sleeping buds on stem. This principle supported archivation and gene-pool preservation of curly birch (in large scale of intraspecific variability) in our country. That was significant contribution for preservation and future effective utilization of this valuable woody plant.

In 1982–1983 has been established also seed orchard. There were planted 89 clones, mostly tree types of curly birch. Each clone represents 10 individuals (grafts) planted in 11 blocks. The distribution of clones within blocks respects their geographic origin, so neighbouring plants come from localities distant from each other.

Apart from mentioned two objects, 66 valuable curly birch clones were planted in Arboretum Borová hora of the Technical University in Zvolen.

Mentioned three objects have considerable value. They represent tools of the *ex situ* gene pool preservation of curly in Slovakia. The native populations of this taxon were endangered by land recultivation. Scattered woody plant vegetation including birch populations has been significantly reduced mainly in the 80-ties.

Concentration of such large diversity of the growth forms and curly birch genotypes provides good conditions for basic research of curly birch and gives opportunity for applied research.

The first study of biological properties of the curly birch clones from seed orchard was done in 1988–1990. There were analysed production of reproductive organs (male and female catkins) and seed quality. In general, quite young plants (6–8 years old) produced small number of reproductive organs and male catkins were predominant. This fact significantly affected also seed quality. The average seed germinability varied from 2,7 % to 9 %. The maximum seed germinability was 36 % [6].

Recently there was analysed germinability of seeds from seed orchard in 2009 and from 20 samples of five clones randomly selected in the orchard. Average value of the seed germinability reached 28 % and varied between 10–46 %. Seed quality was analysed immediately after collection probably increased with the age of curly birch grafts. However, more detailed study of the seed germinability and experimental verification of the pre-sowing treatment would be essential.

In 1993 and 1994 10 clones of the curly birch collection in Arboretum Borová hora were included under controlled hybridization of the various growth forms of curly birch. There were crossed 4 tree forms with white bark, 2 tree forms with black bark, 2 shrub forms with white bark and 2 shrub forms with black bark within. Although 34 hybrid combinations were created, only 16 seed samples were successfully harvested.

Hybrids were planted on the research experimental plot Tále at the altitude 800 m, which is managed by University Forestry Enterprise of the Technical University in Zvolen. The first assessment of the hybrids was done in 1998 at the age of 5 years. Following measurements were done in 1999 and 2001. There were measured height and diameter of the hybrids. The attention was also paid to some qualitative traits representing inheritance of the parent characteristics: bark colour, occurrence of curly grain on the stem and branches and plant habit. At the age of 8 years the average height of analysed hybrid progenies of curly birch varied between 2–3 m. There were found significant differences in height influenced by habit form of parent plants. Progenies where both parents had tree habit were significantly higher than those from hybrid combinations of the shrub forms. The growth form of parent trees had also significant influence on habit form of the progenies. In general, majority of hybrids had tree habit. The highest rate of tree growth forms had combinations where both parents, or at least one of them had tree habit. Decorative timber was indicated in all of the analysed hybrid progenies. In four of them ratio of individuals with curly grain to individuals with ordinary timber was 2:1 and in one progeny it was 1:1. There were identified also individuals with white and black colour of rhytidome, but with respect to quite low age of analysed hybrids results were just informative [7].

Full-sib hybrids of curly birch had good growth characteristics and qualitative traits. Their analysis will follow up in summer 2011, ten years after the first assessment was done.

Prospectives and goals for future research of curly birch in Slovakia. Future research will be focused on seed quality from the seed orchard of curly birch. There will be evaluated qualitative characteristics of the seeds from open pollination (weight of thousand seeds, energy of germination and germinability). The age of clones is about 30 years, so they are now in the stage of full fructification. Assessment of inheritance of the decorative timber in half-sib progenies is also very important. This trait should be known as a significant indicator of the genetic value of seeds from seed orchard. It is considered to be a limiting factor of the commercial utilization of the seed.

Another goal of the basic research will be assessment of the hybrids from controlled hybridization of selected growth forms of curly birch. Hybrids are 18 years old and their growth characteristics should be already balanced. At this age are also well identified other qualitative traits like growth form, presence and type of curly grain and colour of the rhytidome.

According to data obtained from above mentioned experimental work will be modified breeding program of curly birch in Slovakia. The main task is production of tree form hybrids with good growth characteristics and decorative timber.

In Slovakia the potential of curly birch gene-pool can be utilized within forest and non-forest plantations, where should be planted mainly hybrids selected from full-sib progenies. Good conditions for establishment of such types of woody plant cultures are mainly on abandoned agricultural land on stands with reachable terrain.

Establishment and management of curly-birch plantations can be interesting for municipal authorities in various regions of the country. Production of valuable timber offers effective utilization of abandoned agricultural or devastated land and new work opportunities for local people. Above mentioned benefits, curly birch plantations have quite short rotation period. After harvesting stands can be revitalized and for future used in a different way.

Plantations can be established also with half-sib progenies of curly birch grown from improved seed of the seed orchard. For such type of plantations is essential early selection of the individuals with decorative timber already during nursery production of seedlings and young plants.

Beside plantations, curly birch utilization is possible also on devastated stands or on stands, where is vegetation endangered by water deficit during growing season. Silver birch is generally tolerant to water stress and on extreme stands is more competitive against other woody plants.

Wider utilization of curly birch in Slovakia depends on:

– elaboration of the effective nursery technology for plant production and early selection of the plants with decorative timber,

- elaboration of the silviculture techniques and management in curly birch plantations and crops,
- higher awareness about benefits of curly birch growing among foresters, farmers and land owners.

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POLYMORPHISM OF VITAL FORMS OF THE KARELIAN BIRCH IN THE LIGHT OF THE THEORY OF SOMATIC EVOLUTION

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Abstract. Theoretical questions somatic evolution are considered. The hypothesis of occurrence of vital forms of the Karelian birch according to this theory, selection and their fastening depending on growth conditions is offered.

ПОЛИМОРФИЗМ ЖИЗНЕННЫХ ФОРМ КАРЕЛЬСКОЙ БЕРЕЗЫ В СВЕТЕ ТЕОРИИ СОМАТИЧЕСКОЙ ЭВОЛЮЦИИ

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История эволюции наземных растений сложна, однако разными исследователями она трактуется примерно одинаково. Для неё были характерны волны вымирания и замещения, и происходящий время от времени расцвет новых форм, которые становились господствующими. Подробные данные о разнообразии и обилии видов растений на протяжении палеозойской и мезозойской эр практически отсутствуют. Тем не менее, принято считать, что в девонский период, когда возникли первобытные леса, стали распространяться примитивные сообщества хвощей, плаунов и папоротников, размножающихся с помощью спор и предпочитающих влажную среду. В каменноугольный период (карбон) значительного разнообразия достигли растения, продуцирующие пыльцу и семена. Они возникли в девоне, а в перми начался расцвет голосеменных, достигших своего господствующего положения в мезозойской флоре. Наиболее обширная группа голосеменных современной флоры относится к хвойным. В настоящее время их насчитывается около 550 видов, и почти все они произрастают в северном полушарии. Травянистые растения среди них неизвестны. В юрском периоде возникли покрытосеменные или цветковые