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# Growth variability of one-year-old beech (*Fagus moesiac*a Cz.) seedlings and their coppice vigour

**Abstract**

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Height growth of one-year old beech (*Fagus moesiaca* Cz.) seedlings was studied in different environmental conditions: in a closed stand and in a felled site. In a closed stand, the seedlings form a phenotype of a sciomorphic structural form, whereas the seedlings in the felled site show significant divergences compared to the unique and complex biological properties of the seedlings formed in the conditions of the closed canopy. A greater significance of differences between the identical biological properties depends on the sequence of their formation, and the most expressive differences occur in the development of the "above-epicotyl-axis". The significantly different length of the "above-epicotyl-axis" in the seedlings formed in different environmental conditions also conditions a significantly different number of the leaves and axillary buds. In this way, in the same seedling growth stage, the potential of the coppicing base of the dormant buds in the seedlings of sciomorphic structural form (two opposite buds in cotyledon axil, two opposite buds in primary leaf axils) is significantly different from the potential of the coppicing base from the dormant buds in the seedlings with a higher growth intensity of the "above-epicotyl-axis".

## Introduction

In the earliest phases of ontogenesis, the environmental conditions are decisive for the biological characteristics of Moesian beech (Bobinac & Vilotić 1995, 1996; Bobinac 1999, 2002, 2003). In this way, environmental conditions also affect the coppice vigour of beech dormant buds occurring after several decades of direct anthropogenic influence. After Pjatnickij & al. (1963), the application of a particular stand cultivation system can also affect the coppicing base. Taking into account that the coppicing base of a stump is defined by stump diameter and height, and that under a particular silvicultural system stump diameter depends mostly on tree age, while stump height is a constant magnitude, the coppicing base potential of the preventive buds of adult beech trees is primarily conditioned by the growth characteristics of seedlings in the initial phases of development.

This paper deals with the coppicing base potential of the preventive buds in one-year old beech seedlings from different site condiztions.

## Material and methods

Morphological characteristics of beech seedlings during the first vegetation growth period were studied on two types of regeneration areas at the site of montane beech forest on deep eutric brown soil. Fifty dominant seedlings with undisturbed growth were analysed from each the closed canopy part of the stand and the central part of the circular felled site, by the random sample principle. The following quantitative parameters were measured:

1. length of hypocotyl, from the base of cotyledons to the widest part of root collar zone ($H_y$),
2. length of epicotyl, from the base of cotyledons to the base of primary leaves ($E_p$),
3. length of "above-epicotyl-axis", from the axil of primary leaves to the base of terminal bud ($I_h$),
4. thickness of the widest part of root collar zone ($d_{kv}$),
5. thickness of the hypocotyl, about 5 mm below the base of cotyledons ($d_{Hy}$),
6. thickness of the middle of epicotyl part ($d_{Ep}$),
7. number of leaves (B.L.),
8. number of large vegetative buds, terminal and large lateral buds (B.P.).

All linear parameters are expressed in mm. The testing of differences between mean values was performed by t-test.

## Results

In beech germination, cotyledons emerge above the ground surface (epigeal germination – intermediary type according to Schütt & Werner 1978). The mean values of the study seedling parameters and the results of t-test are presented in Table 1. In the conditions of the closed canopy, the length of "above-epicotyl-axis" ranged from 0.4 mm to 3.0 mm, mean length was 2.01 mm. In the conditions of the felled site, the length of sylepticaly formed "above-epicotyl-axis" ranged from 15.0 mm to 112.0 mm, mean length was 56.28 mm. The seedling height during the first year ranged between 81.6 mm and 144.0 mm, with mean height 113.19 mm in the conditions of the closed canopy and 145.0 mm to 314.0 mm, with mean height 188.06 mm, in the conditions of the felled site. The seedlings in the conditions of the closed canopy form two opposite primary leaves, and the seedlings in the felled site, in addition to the two opposite leaves on the "above-epicotyl-axis", also form 4-15 alternate leaves.

In the same seedling growth stage, the total potential of the coppicing base of the dormant buds in the seedlings of sciomorphic structural form (two opposite buds in the cotyledon axil, two opposite buds in primary leaf axils) is lower than the potential of the coppicing base of seedlings with a higher growth intensity of the "above-epicotyl-axis". Also, on the averagely shorter length of the internode between the two opposite buds in the cotyledon axil and in primary leaf axils, the potential coppicing base of the dormant buds is higher in the seedlings growing on the felled site. However, the total potential coppicing base of the preventive buds at the constant stump height is higher, per stump height unit, in adult beech trees originating from the seedlings of sciomorphic structural form than in beech trees originating from the seedlings with a more intensive growth in the first and in the following years.

Table 1: Mean values of biological parameters of Moesian beech seedlings in the first year in different stand conditions and the results of t-test.

| Parameter | Stand conditions | | Probability | |
|---|---|---|---|---|
| | Closed canopy | Felled site | *p* | significance |
| $H_y$ (*mm*) | 75.40 | 70.22 | 0.049485 | * |
| $E_p$ (*mm*) | 35.77 | 31.36 | 0.001972 | ** |
| $I_h$ (*mm*) | 2.01 | 56.28 | 0.000000 | *** |
| $H_t$ (*mm*) | 113.19 | 188.06 | 0.000000 | *** |
| $d_{kv}$ (*mm*) | 1.81 | 3.18 | 0.000000 | *** |
| $d_{Hy}$ (*mm*) | 1.22 | 2.18 | 0.000000 | *** |
| $d_{Ep}$ (*mm*) | 0.82 | 1.89 | 0.000000 | *** |
| B.L. (pcs) | 2.00 | 8.14 | 0.000000 | *** |
| B.P. (pcs) | 1.00 | 4.40 | 0.000000 | *** |

## Conclusions

Seedlings formed in the closed canopy have the phenotype of sciomorphic structural form, with a poorly expressed (regularly leafless) syleptically formed "above-epicotyl-axis".

Seedlings in the felled site regularly have a more intensive growth of "above-epicotyl-axis" than the seedlings in the completely closed canopy and thus the higher seedlings at the end of the first vegetation period, more numerous leaves, i.e. a higher number of vegetative buds in their axils.

In the same seedling growth stage, the potential of the coppicing base of the dormant buds in the seedlings of sciomorphic structural form is lower than the potential coppicing base of the seedlings with a higher growth intensity of the "above-epicotyl-axis".

The total potential of the coppicing base of dormant buds at the constant stump height, which is under the direct anthropogenic influence, is higher in adult beech trees originating from the seedlings of sciomorphic structural form.

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