ANALYSIS OF GENOTYPIC AND PHENOTYPIC TRAITS IN NATURAL POPULATIONS OF BEECH IN THE WESTERN AREA OF ROMANIA (III)

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Abstract

Woody species in the national forest formations are found in different forest stands forming a structural and functional complexity varied. The study shows genetic interpopulational variability doubly important, fundamental and applied. A large area of forest is regenerated based on afforestation material derived from natural forests, respectively reserves of seeds selected according to the particular phenotypic properties (growth, uniformity, shape). They serve at the discretion silvicultural characters variability of populations originating in practical terms, to identify the best seed sources for reforestation. Comparison of molecular and phenotypic their plan allows understanding the evolution of populations of forest trees.

An aspect of great present interest in the context of preserving the forest's genetic resources, is the genetic improvement of the beech, either by promoting genetic principles through sewing work and natural regeneration, or by using a reproduction material in the sewing, material resulted from a process of guided modification of genetic structure.

Key words: branch, variability, slemderness, frost shape, trunk forking, quantitative characters

INTRODUCTION

The genetic variability of the natural populations is the result of more factors that exert themselves antagonistically with homogenous or diversified actions: history, natural selection, gene migration, randomness, etc. The beech variability is a very obvious reality for many characters whose simple alllelic and polyallelic control can probably appear.

MATERIAL AND METHOD

Interpopulational variability study of beech in 11 natural populations of beech sampled, aged over 100 years, was performed in the fall of 2015 using the methods of biostatistics (Morgestern, 1996; Geburek, Müller, 2004; Mateescu, 2005; Pârnuţă et al., 2005; Hosius et al., 2006; Wehenkel et al., 2007; White et al., 2007; Kent, Weir, 2009; Mihai, 2009). In each population studied was chosen by 30 beech trees using the criterion of representativeness, each measuring the tree and observing each 27 characters or trees directly or through estimates, the resulting data is processed by simple analysis of variance (Ceapoiu, 1968; Ciobanu, 2003; Konnert, Ruetz, 2003; Wade, 2007; Gömöry et al., 2010; Schneider, 2011;

Commarmot et al., 2013). Data analysis was performed after hours Statistics, 1991.

When selecting populations were taken into account both height as the main ecological gradient in the area of Romanian beech and stationary condition varied due to different environmental factors (Enescu et al., 1988, Ienciu et al., 2004). For the study of interpopulation variation of the population this group over 100 years were divided into two groups of elderly: the first between 101-120 years - seven populations: 1-Dobreşti (105 years old, C.P I), 7-Hălmagiu (104 years old, C.P I), 12-Cîmpeni (108 years old, C.P I), 18-Văliug (120 years old, C.P II), 19-Reşiţa (110 years old, C.P III), 24-Nera (120 years old, C.P III) and 26-Băile Herculane (105 years old, C.P III) and the second between 121-140 years comprising four populations as follows: 3-Remeţi (138 years old, C.P II), 6-Vaşcău (122 years old, C.P II), 8-Gîrda (130 years old, C.P III) and 13-Baia Mare (130 years old, C.P III), 10-Beliu population was excluded because it could not be integrated in any age group.

RESULTS AND DISSCUSION

The study for the age of 101-120 years interpopulational variation reveals very different coefficients of variation for the characters studied (Table 1). Regarding quantitative characters of tree trunk variation in phenotypic level interpopulational for this age group it was average except height to the first branch ellagic, of slenderness and volume trunk that had a variation interpopulational wide variation coefficients being 29,632%, 23,529% and 34,992%.

Regarding the populations of this group for some qualitative characters of the trunk as trunk forking, cylindric trunk, straightness of the trunk, pruning, bark color and shape variation interpopulational crust was average coefficients of variation not exceeding 20%. Regarding other qualitative character of the tree trunk that form the base of the trunk, rhitidom it was observed that the variation is wide and very wide to form rhitidom coefficient of variation exceeding 100%. Regarding the character of the crown in the age group 101-120 years it was observed that some characters such as vertical crown shape, symmetry crown, thick branches and insertion angle of the branches have a interpopulational variation average coefficients of variation obtained exceeding 20%.

For one character, position branches interpopulational variation was found namely small, variation coefficient was 6,527%. If characters crown diameter and crown height recorded was wide variation coefficient of variation being 25,860% and 23,217%.

Table 1

Statistical indicators of characters measured or observed in beech populations aged over 100 years in Carpathian area of the country - the age group 101-120 years

No.	Character	$\overline{x}$ ±e	σ	cv
1.	Diameter la 1,3 m (cm)	37,635±2,099	5,553	14,754
2.	Total height (m)	30,385±1,735	4,590	15,106
3.	The height to the first branch ellagic (m)	13,547±1,581	4,017	29,632
4.	Slenderness (Hm/Dcm)	0,867±0,077	0,204	23,529
5.	Trunk volum (m^3)	1,909±0,252	0,668	34,992
6.	Forking trunk (indici)	1,542±0,061	0,162	10,505
7.	Cylindric trunk (indici)	1,251±0,067	0,178	14,228
8.	Rectitude trunk (indici)	1,928±0,084	0,223	11,566
9.	Trunk shape base (indici)	1,994±0,161	0,426	21,364
10.	Pruning (indici)	1,112±0,053	0,141	12,267
11.	Bark color (indici)	2,168±0,147	0,389	17,942
12.	Shape color (indici)	1,237±0,078	0,207	16,734
13.	Rhitidom (indici)	1,255±0,104	0,277	22,071
14.	Rhitidom shape (indici)	0,444±0,174	0,462	104,054
15.	Crown diameter (m)	9,122±0,891	2,359	25,860
16.	Crown height (m)	16,845±1,478	3,911	23,217
17.	Vertical funnel shaped crown (indici)	3,128±0,204	0,540	17,263
18.	Symmetry crown (indici)	1,577±0,106	0,281	17,818
19.	Thick branches (indici)	1,910±0,085	0,226	11,832
20.	Insertion angle of branches (indici)	1,904±0,117	0,310	16,281
21.	Position branches (indici)	1,777±0,044	0,116	6,527
22.	Chinese beards (indici)	1,380±0,111	0,294	21,304
23.	Frost shape (indici)	1,108±0,033	0,088	7,942
24.	Spun fiber (indici)	1,562±0,128	0,340	21,766
25.	Wood density (g/cm^3)	0,593±0,006	0,017	2,866
26.	The total thickness of annual rings (mm)	34,210±1,622	4,292	12,546
27.	False heartwood (indici)	0,192±0,077	0,205	106,770

$\overline{x}$ ±e – mediate ± media error
σ – standard deviation
cv – coefficient of variation

For other characters of tree trunk - adaptive characters - Chinese and frost shape beards in this age group recorded was wide variation and that small. If we study some characters of wood, such as fiber torsion and false heartwood is interpopulational variation of these characters is large and very large, if false heartwood, coefficient of variation even exceeding 100%.

Regarding the wood density was observed that this character has a small phenotypic variation, variation coefficient of only 2,866% for this age group. Another character of the wood, the total thickness of tree rings showed an average variation coefficient of variation not exceeding 20% for this age group.

Interpopulational study of variation for the age of 101-120 years, production classes, indicate that there are three populations of the same class production him – I - 1-Dobreşti, 7-Hălmagiu, and 12-Cîmpeni and three populations with class production - III – 19-Reşiţa, 24-Nera and 26-Băile Herculane. This study revealed that the coefficients of variation were different from one character to another.

Phenotypic variation of quantitative characters of tree trunk for populations with production class I was small overall height, the variation coefficient of only 3,714% and the range for the other characters. In exchange for the populations of third grade production (class III) of phenotypic variation it was small for these characters except height to the first branch ellagic and trunk volume, which showed a wide variation.

Interpopulational variation of quality characters trunk populations from grade I to production was average for most characters, the variation coefficients hovering around 20%. A phenotypic variation than was observed for cylindric torso shape of the trunk and a very broad and wide variation was observed in the color of the crust and form rhitidom characters, the coefficients of variation being 26,434% to 128,078%. For class III manufacturing interpopulational variation was small for trunk straightness, forking of the trunk and the color of the crust, medium for cylindric trunk, torso-shaped base, pruning and form crust, and for rhitidom and form rhitidom was wide.

Referring to some characters crown is found populations of first class production that thick branches and position the branches have little variation, canopy diameter and height of the crown have a wide variation, remaining characters showed a variation average coefficients of variation not exceeding 20%. In contrast, populations in class III production was recorded a small change in angle and position of insertion of the branches of large branches and canopy diameter other characters showed a variation middle. For other adapting characters such as Chinese and frost shape beards, they had interpopulational variability middle for class I populations in the production and middle or lower class populations III production.

Study of characters of timber trees such as fiber torsion revealed a wide phenotypic variation for all characters except that wood density showed little variation for populations in class production, variation coefficient of only 1,827%. In contrast, the populations of class III manufacturing interpopulational variability had little value for the total thickness of the annual rings, fiber spinning and higher average wood density and false heartwood. Quantitative analysis of variance interpopulational character of the tree trunk by age revealed that in case of group of 101-120 years, the highest values of 1,3 m diameter were recorded for the 1-Dobreşti population, showing that population and total heights higher than the general population (Fig. 1).

High levels of total height were observed in populations 7-Hălmagiu and 12-Cîmpeni. With regard to the first branch height ellagic 1-Dobreşti populations are distinguished 12-Cîmpeni who heights above the average experiment. Trunk volume is distinguished by the highest values for 1-Dobreşti population and the lowest population 7-Hălmagiu, even with the same class production him, the age difference between the two populations is one year class productivity of the resort is the same - class productivity of the resort is the same - the upper 1-Dobreşti population is favored by the type of soil on which vegetate - eutricambosoil, while 7-Hălmagiu population has grown on a luvosoil.

Crown height was observed that the population 7-Hălmagiu and 24-Nera their highest heights, the latter showing population and large diameter crown (Fig. 2).

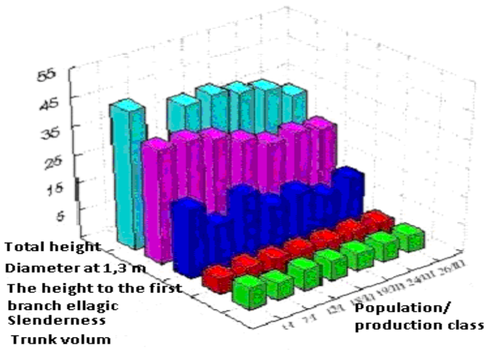

Fig. 1. Variation in quantitative characters of the trunk on the population studied in the age group 101-120 years

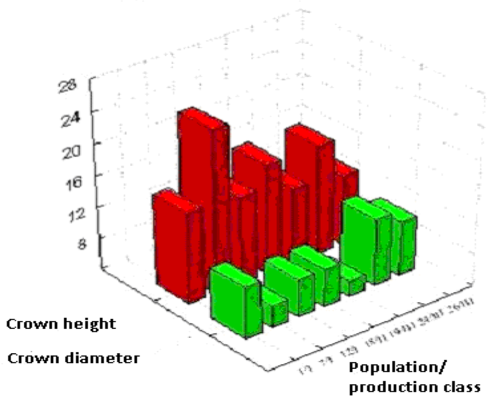

Fig. 2. Variation characters crown on the population studied in the age group 101-120 years

For the total thickness of annual rings it was found that 1-Dobreşti populations, 12-Cîmpeni and 19-Reşiţa values slightly higher than other populations studied (Fig. 3). Regarding the density of wood, not distinguished either population, all showing similar values for this character.

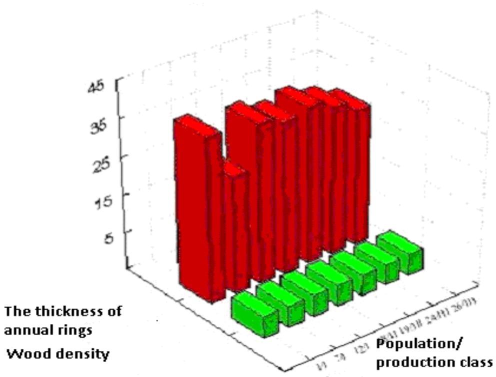

Fig. 3. Variation of wood characters depending on the population studied in the age group 101-120 years

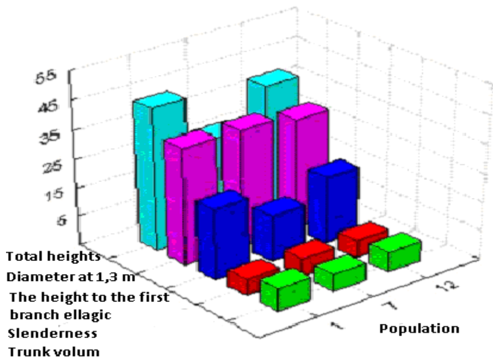

Fig. 4. Variation in quantitative characters of the trunk on the population studied in the age group 101-120 years the production of class I

Populations 1-Dobreşti, 7-Hălmagiu, 12-Cîmpeni belong to harvesting areas close namely G 140, G 240, respectively G 440, the other two populations, 19-Reşiţa and 24-Nera belong to the same harvesting areas namely F 340. These populations grow at an average altitude populations except 12-Cîmpeni şi 24-Nera that grow at higher altitudes of 800-1000 m. In terms of soil type, 1-Dobreşti populations, 12-Cîmpeni and 19-Reşiţa grow on eutricambosoil, population 7-Hălmagiu on luvosoil and 24-Nera on districambosoil population.

It was noted that of the three populations of the same class production - I - 1-Dobreşti, 7-Hălmagiu and 12-Cîmpeni population stands 1-Dobreşti (Fig. 4) with the highest values for most characters analyzed (Fig. 5), even if all populations vegetate at an average altitude on the same type of soil - eutricambosoil except 7-Hălmagiu population which grown on luvosol, and the same class productivity resort - top (Fig. 6).

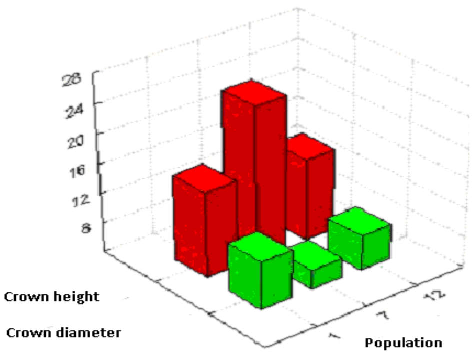

Fig. 5. Variation characters crown on the population studied in the age group 101-120 years the production of class I

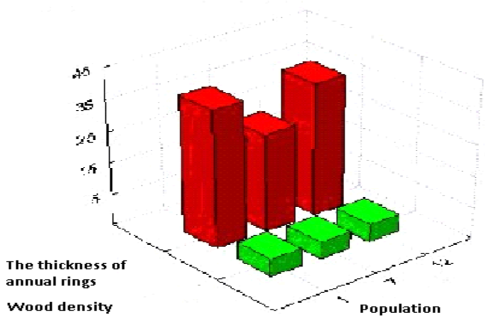

Fig. 6. Variation of wood characters depending on the population studied in the age group 101-120 years the production of class I

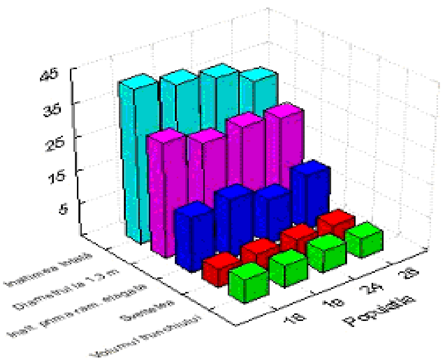

Fig. 7. Variation in quantitative characters of the trunk on the population studied in the age group 101-120 years the production of class III

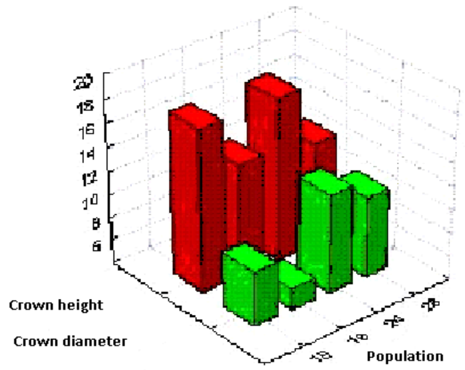

Fig. 8. Variation characters crown on the population studied in the age group 101-120 years the production of class III

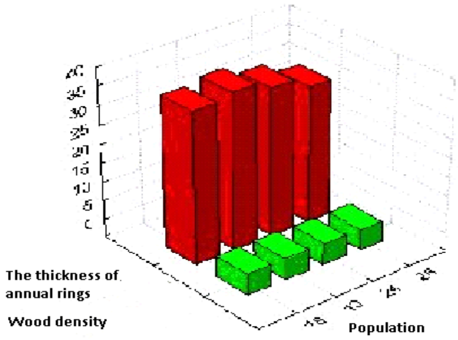

Fig. 9. Variation of wood characters depending on the population studied in the age group 101-120 years the production of class I

Of the three populations of the same class production - III – 19-Reşiţa 24-Nera and 26-Băile Herculane stood populations 19-Reşiţa (Fig. 7) high values for quantitative characters and some characters trunk of wood (Fig. 8) and 24-Nera population with high values for characters crown even if all populations vegetate at an average altitude on very different types of soil, they growing on the basic soils (Fig. 9) and a middle productivity resort.

CONCLUSIONS

This study is important for the knowledge of the extremely valuable genetic inheritance that this species of trees own. The result of this research led to the knowledge of the interpopulational variability of some natural beech populations from the western part of our country.

Changes interpopulational in all populations studied were very different from one character to another, by age and production classes, results allowing developing scientifically a strategy to be used in the breeding program phage vernacular, such phage presents a high degree of heterozygosity, especially in natural populations with their infinite amplitudes of genetic.

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