INTERPOPULATIONAL VARIABILITY IN NATURAL BEECH POPULATIONS (*FAGUS SYLVATICA* L.) OF THE INTRA-CARPATHIAN AREA OF ROMANIA

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Abstract

The aim of the research that have already been done was the study of the interpopulational variability of some natural beech populations from the western part of our country, in order to select the valuable populations of some superior genotypes, so as to use them as forest selected reproductive materials.

Key words: genotype, pruning, rhytidome, frost cracks

INTRODUCTION

The necessity of the scientific experimental substantiation of the capacity of the beech populations, on the whole to vary with regard to the genotype and phenotype features has imposed this research with deep implications in the forest practice.

MATERIAL AND METHODS

The study of the interpopulational variability of the beech in the 16 sampled natural populations of beech, with the age up to 100 years, was carried out with the help of the biostatic methods (Enescu, Ioniță, 2000).

In each studied population, there were chosen 30 beech trees respectively, using the criterion of the representativeness, for each tree 27 characteristics were measured and observed, either directly on the trees, or by estimations, the resulted data being processed by the simple analysis of the variation (Ceapoiu, 1968; Enescu, Muhs, 1988). The analysis of the data was carried out according to the Statistica (Statistics programme, 1991; Merzeau, Comps, Thiébaut et al., 1994).

For the choice of the populations there were taken into account both altitude, as the main ecological gradient of the Romanian area of the beech, and the very varied stationary conditions determined by different environmental factors (Enescu, Doniță, Bândiu et al., 1988; Enescu, Cherecheş, Bândiu, 1997; Paule, 1992).

For the study of the interpopulational variation, this group of populations of up to 100 years, was devided into two subgroups of the ages: the first between 61-80 years – five populations: 11-Gurahonț (72 years, C.P II), 14-Mara (72 years, C.P II), 16-Făget (72 years, C.P II), 23-Mehadia (80 years, C.P I) and 28-Gilău (65 years, C.P III) and the second between 81-100 years, including ten populations: 2-Sudrigiu (93 years, C.P II), 4-Marghita (89 years, C.P I), 5-Aleşd (81 years, C.P I), 9-Sebiş-Moneasa (82 years, C.P I), 17-Coşava (97 years, C.P II), 20-Anina (85 years, C.P II), 21-Teregova (90 years, C.P II), 22-Caransebeş (91 years, C.P I), 25-Bozovici (90 years, C.P II) and 27-Huedin (90 years, C.P II), the population 15-Tîrgu Lăpuş being excluded because it does not fit into either of the subgroups.

RESULTS AND DISCUSSION

The study of the interpopulational variation for the age group 61-80 years, has revealed the fact that the coefficients of variation were different from one feature to the other (table 1).

The phenotype variation of the quantitative features of the trunk of the trees for the first age group was in general average, except the diameter at 1,3 m, the total height and the volume of the trunk that have shown a wide variation (Ienciu, Savatti, 2004).

For the first age group, the interpopulational variation of some qualitative features of the trunk of the trees, like the trunk forking, the cylindricality of the trunk, the pruning, the shape of the bark and the rhytidome was average, the values of the coefficients of variation being around 20%.

Another feature of the trunk, like the colour of the bark, had much smaller values, the coefficient of variation being of only 8,315%. The coefficients of variation obtained in the case of the rectitude of the trunk and the shape of the trunk at the base were higher, of 21,277% and 32,585%, respectively. The widest phenotype variation was noticed in the case of the feature of the shape of the rhytidome, the coefficient of variation being of 108,809%.

As far as some features of the crown are concerned, it is noticed for the first age group that the symmetry of the crown has an average variation; the coefficient of variation does not exceed 20% (16,548%). However, for the thickness of the branches, the insertion angle of the branches and the position of the branches, the recorded variation was small; the obtained coefficients of variation were of 6,084%, 6,154% and 5,903%.

A wide variation was recorded for the features of the diameter of the crown, the height of the crown and the shape of the crown in a vertical plane, the coefficients of variation being of 21,201%, 36,198% and 20,986%, respectively.

Regarding other features of the trunk of the trees – the adaptation features, like the Chinese beards and the frost cracks, these have shown an average interpopulational variability; the coefficients of variation have not exceeded 20%.

Table 1

Statistic indicators of the measured or observed features in the beech populations with ages up to 100 years in the Western part of the country – age group 61-80 years

Nr.	Feature	$\bar{X} \pm e$	σ	cv
1.	The diameter at 1,3 m (cm)	27,488±2,661	5,951	21,649
2.	The total height (m)	23,220±2,496	5,584	24,048
3.	The height up to the first pruned branch (m)	12,166±0,808	1,808	14,861
4.	Slenderness (Hm/Dcm)	0,894±0,063	0,142	15,883
5.	The volume of the trunk (m^3)	0,910±0,272	0,609	66,923
6.	The forking of the trunk (indices)	1,780±0,122	0,274	15,393
7.	The cylindricality of the trunk (indices)	1,332±0,089	0,200	15,015
8.	The rectitude of the trunk (indices)	1,988±0,189	0,423	21,277
9.	The shape of the trunk at the base (indices)	1,872±0,117	0,261	32,585
10.	The pruning (indices)	1,414±0,130	0,292	20,650
11.	The colour of the bark (indices)	1,900±0,070	0,158	8,315
12.	The shape of the bark (indices)	1,226±0,107	0,240	19,575
13.	The rhytidome (indices)	1,218±0,096	0,216	17,733
14.	The shape of the trunk (indices)	0,420±0,204	0,457	108,809
15.	The diameter of the crown (m)	8,240±0,781	1,747	21,201
16.	The height of the crown (m)	10,926±1,769	3,955	36,198
17.	The shape of the crown in a vertical plane (indices)	3,040±0,285	0,638	20,986
18.	The symmetry of the crown (indices)	1,414±0,104	0,234	16,548
19.	The thickness of the branches (indices)	1,660±0,045	0,101	6,084
20.	The insertion angle of the branches (indices)	1,706±0,047	0,105	6,154

21.	The position of the branches (indices)	1,694±0,044	0,100	5,903
22.	The Chinese beards (indices)	1,458±0,096	0,216	14,814
23.	The frost cracks (indices)	1,246±0,102	0,229	18,378
24.	Spiral grain (indices)	1,776±0,098	0,220	12,387
25.	The density of the wood (g/cm^3)	0,558±0,020	0,046	8,243
26.	The total thickness of the annual rings (mm)	34,648±1,020	2,282	6,586
27.	The false duramen (indices)	0,176±0,043	0,097	55,113

The study of some features of the wood of the trees, like the spiral grain, has revealed an average phenotype variation for this age group and, in the case of the density of the wood and of the total thickness of the annual rings, a small variation. Another feature of the wood of the trees: the false duramen has shown a large variation, the coefficient of variation being of 55,113%.

The study of the interpopulational variation for the age group 61-80 years and the production classes underlines the existence of three populations with the same production class – II – 11-Gurahonț, 14-Mara and 16-Făget. This study has revealed the fact that the coefficients of variation were different from one feature to the other (table 2).

The interpopulational variation of the quantitative features of the trunk was small for the diameter at 1,3 m and the height up to the first pruned branch, average for the total height and slenderness and large for the volume of the trunk, with a coefficient of variation of 35,950%.

Table 2

Statistic indicators of the measured or observed features in the beech populations with ages up to 100 years in the Western part of the country – age group 61-80 years and production class II

Nr.	Feature	$\overline{X} \pm e$	Σ	cv
1.	The diameter at 1,3 m (cm)	26,333±1,186	2,055	7,803
2.	The total height (m)	23,456±1,515	2,624	11,186
3.	The height up to the first pruned branch (m)	11,686±0,548	0,950	8,129
4.	Slenderness (Hm/Dcm)	0,946±0,095	0,165	17,441
5.	The volume of the trunk (m^3)	0,815±0,169	0,293	35,950
6.	The forking of the trunk (indices)	1,633±0,100	0,173	10,593
7.	The cylindricality of the trunk (indices)	1,253±0,129	0,224	17,877
8.	The rectitude of the trunk (indices)	2,166±0,268	0,465	21,468
9.	The shape of the trunk at the base (indices)	1,943±0,144	0,250	12,866
10.	The pruning (indices)	1,546±0,153	0,265	17,141
11.	The colour of the bark (indices)	1,900±0,115	0,200	10,526
12.	The shape of the bark (indices)	1,100±0,085	0,147	13,363
13.	The rhytidome (indices)	1,110±0,095	0,165	14,864
14.	The shape of the trunk (indices)	0,190±0,170	0,294	154,736
15.	The diameter of the crown (m)	7,056±0,502	0,869	12,315
16.	The height of the crown (m)	11,876±1,310	2,269	2,265
17.	The shape of the crown in a vertical plane (indices)	3,376±0,186	0,323	9,567
18.	The symmetry of the crown (indices)	1,423±0,175	0,304	21,363
19.	The thickness of the branches (indices)	1,643±0,046	0,080	4,869
20.	The insertion angle of the branches (indices)	1,766±0,020	0,035	1,981
21.	The position of the branches (indices)	1,756±0,013	0,023	1,309
22.	The Chinese beards (indices)	1,353±0,046	0,080	5,912
23.	The frost cracks (indices)	1,133±0,088	0,152	13,415
24.	Spiral grain (indices)	1,836±0,166	0,288	15,686
25.	The density of the wood (g/cm^3)	0,556±0,037	0,065	11,690
26.	The total thickness of the annual rings (mm)	33,980±0,626	1,085	3,193
27.	The false duramen (indices)	0,200±0,000	0,000	0,000

For the quantitative features of the trunk of the trees it was noticed an average interpopulational variation for most of the features, except the rectitude of the trunk that had a wide variation, with a coefficient of variation of 21,468% and the shape of the rhytidome with a very wide variation and a coefficient of variation of 154,736%. The phenotype variation of the features of the crown was generally small, except the diameter of the crown that showed an average variation, the coefficient of variation being of 12,315% and the symmetry of the crown with a large variation, the coefficient of variation being of 21,363%.

For other features of the trunk – the adaptation features, the interpopulational variation was small for the feature Chinese beards and average for frost cracks.

Some features of the wood of the trees have shown an average variation – the spiral grain and the density of the wood, and the total thickness of the annual rings a small variation. For the false duramen there was recorded no interpopulational variation. If we make a comparative analysis of the variation of the features on age groups, we notice that among the group 61-80 years, the population 23-Mehadia can be distinguished, that has diameters at 1,3 m and heights that are higher than the rest of the populations (only the quantitative features were represented graphically) (fig.1), the same population is distinguished also in the case of the height of the crown and the diameter of the crown, presenting higher values than the rest of the populations, having a production class that is superior in comparison to the other populations (fig.2).

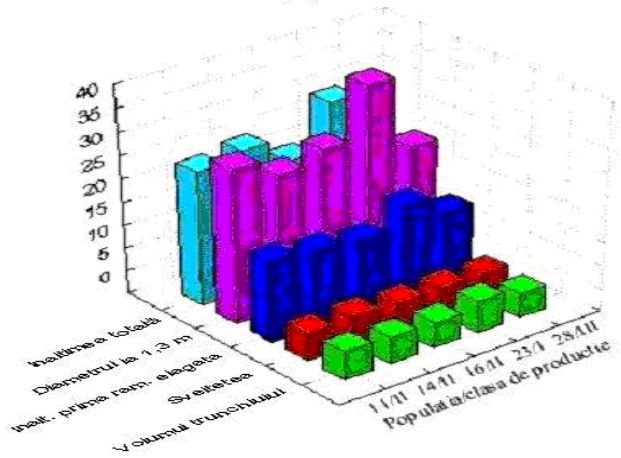

Fig.1Variation of the trunk quantitative features depending on the studied population in age group 61-80 years

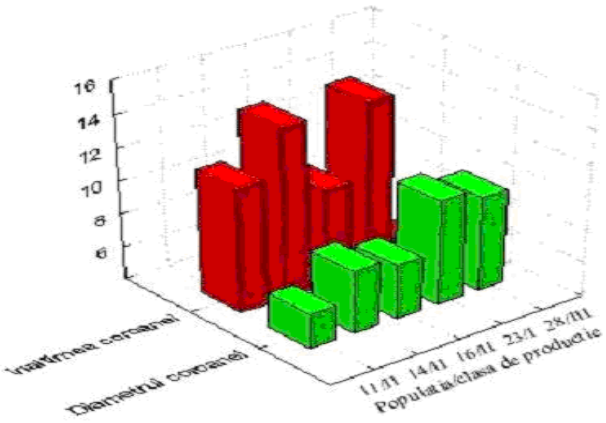

Fig.2 Variation of some crown features depending on the studied population in age group 61-80 years

For the height of the crown, large values were recorded also in the case of the population 14-Mara, and for the diameter of the crown, values over the average were noticed also in the case of the population 28-Gilău. The population 23-Mehadia had values slightly over the average of the experiment also in the case of the total thickness of the annual rings (fig.3). This population belongs to the harvesting area F 340 – hilly beech forests and it vegetates at an average altitude of over 600 m, on a soil of the type eutricambosoil.

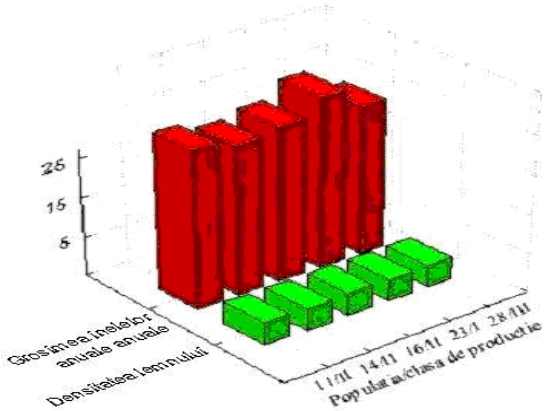

Fig.3Variation of some wood features depending on the studied population in age group 61-80 years

The other two populations that have distinguished in the case of this age group belong to other harvesting areas, that is, the population 14-Mara belongs to the area A 120 – mixed beech and resinous trees forests, and the population 28-Gilău to the area G 340 – hilly beech forests. The altitudes at which these populations vegetate are also different, that is, the population 14-Mara grows at altitudes of over 1200 m, while the population 28-Gilău grows at altitudes between 520-850 m. Regarding the type of soil it can be noticed that the population 28-Gilău grows on the same type of soil as the population 23-Mehadia - eutricambosoil, while the population 14-Mara grows on a soil of the type districambosoil.

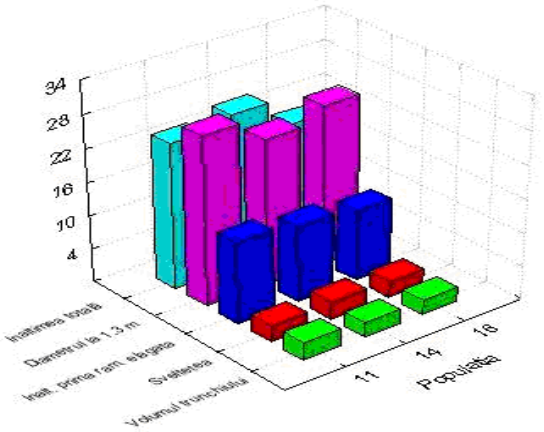

Fig.4 Variation of the trunk quantitative features depending on the studied population in age group 61-80 years belonging to the class of production II

It was also noticed that, from the three populations with the same production class – II – 11-Gurahonț, 14-Mara and 16-Făget, there have distinguished both the population 11-Gurahonț (fig.4) for the quantitative features of the trunk and for those of the wood, and also the population 14-Mara (fig.5) with a growth vigour and a growth of the vegetation higher than at the other two populations (all three populations having the same age), even if they vegetate at a higher altitude, the production class of the station being the same for these populations – average, the population 14-Mara being favoured by the type of soil on which it vegetates – districambosoil, while the populations 11-Gurahonț and 16-Făget vegetate on a preluvosoil (fig.6) (Lazăr, 2008).

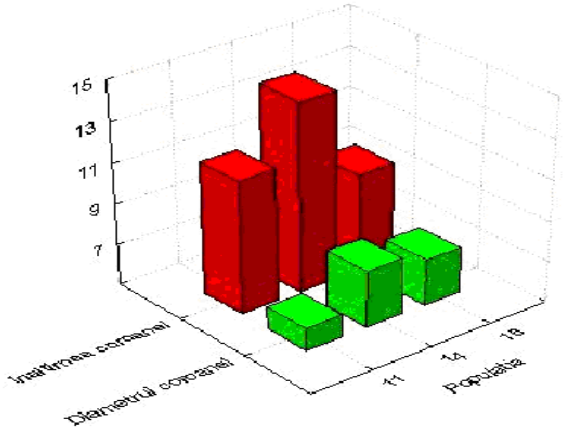

Fig.5 Variation of some crown features depending on the studied population in age group 61-80 years belonging to the class of production II

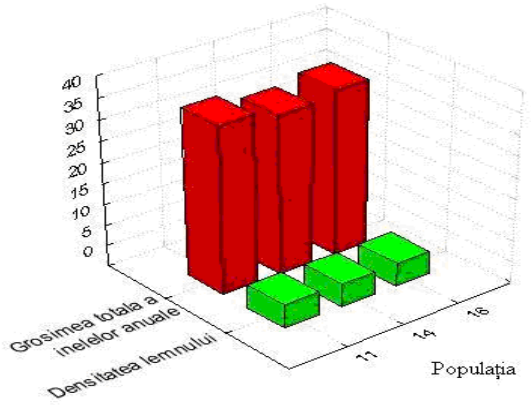

Fig.6 Variation of some wood features depending on the studied population in age group 61-80 years belonging to the class of production II

CONCLUSION

It was noticed that the interpopulational variation at the level of all the studied populations, was very different from one feature to the other, on age groups and production classes, this study being important for the knowledge of the extremely valuable genetic patrimony, which this species of trees has.

The results of the carried out research have lead to the knowledge of the interpopulatinal variability of some natural populations of beech, and together with those from the specialized national and international literature they will allow the substantiated scientific elaboration of a strategy and tactics which can be used in the process of the improvement of the beech in our country.

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