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

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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: (maximum 6): correlation, climate-yield, irrigation, de Martonne aridity index wheat, crop rotation

INTRODUCTION

The need for scientific substantiation experimentally capacity beech populations as a whole to vary in terms of genotypic and phenotypic characteristics have imposed this research with deep implications in forestry practice.

MATERIAL AND METHOD

Interpopulational variability study of beech in 16 natural populations of beech sampled, aged up to 100 years, was performed using the methods of biostatistics (Mateescu, 2005; Kent, Weir, 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; Schneider, 2011; Wade, 2007). 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, Doniță, Bândiu et al., 1988, Ienciu Andra, Savatti, 2004). For the study of interpopulation variation of the population this group up to 100 years were divided into two groups of elderly: the first between 61-80 years - five populations: 11-Gurahonț (72 years old, CP II), 14-Mara (72 years old, CP II), 16-Făget (72 years old, CP II), 23-Mehadia (80 years old, CP I) and 28-Gilău (65 years old, CP III), and the second between 81-100 years comprising ten populations as follows: 2-Sudrigiu (93 years old, CP II), 4-Marghita (89 years old, CP I), 5-Aleşd (81 years old, CP I), 9-Sebis-Moneasa (82 years old, CP I), 17-Coşava (97 years old, CP II), 20-Anina (85 years old, CP II), 21-Teregova (90 years old, CP II), 22-Caransebe§ (91 years old, CP I), 25-Bozovici (90 years old, CP II) and 27-Huedin (90 years old, CP II) being excluded Târgu Lăpuş 15 people who do not fit in any subgroup.

RESULTS AND DISSCUSIONS

Study interpopulational variation for 61-80 years age group, revealed that the coefficients of variation were different from one character to another (Table 1).

Table 1

Statistical indicators of characters measured or observed in beech populations aged up to 100 years in the west - the age group 61-80 years

No.	Character	$\bar{x}$ ±e	σ	cv
1.	Diameter la 1,3 m (cm)	27,488±2,661	5,951	21,649
2.	Total height (m)	23,220±2,496	5,584	24,048
3.	The height to the first branch ellagic (m)	12,166±0,808	1,808	14,861
4.	Slenderness (Hm/Dcm)	0,894±0,063	0,142	15,883
5.	Trunk volum (m^3)	0,910±0,272	0,609	66,923
6.	Forking trunk (indici)	1,780±0,122	0,274	15,393
7.	Cylindric trunk (indici)	1,332±0,089	0,200	15,015
8.	Rectitude trunk (indici)	1,988±0,189	0,423	21,277
9.	Trunk shape base (indici)	1,872±0,117	0,261	32,585
10.	Pruning (indici)	1,414±0,130	0,292	20,650
11.	Bark color (indici)	1,900±0,070	0,158	8,315
12.	Shape color (indici)	1,226±0,107	0,240	19,575
13.	Rhitidom (indici)	1,218±0,096	0,216	17,733
14.	Rhitidom shape (indici)	0,420±0,204	0,457	108,809
15.	Crown diameter (m)	8,240±0,781	1,747	21,201
16.	Crown height (m)	10,926±1,769	3,955	36,198
17.	Vertical funnel shaped crown (indici)	3,040±0,285	0,638	20,986
18.	Symmetry crown (indici)	1,414±0,104	0,234	16,548
19.	Thick branches (indici)	1,660±0,045	0,101	6,084
20.	Insertion angle of branches (indici)	1,706±0,047	0,105	6,154
21.	Position branches (indici)	1,694±0,044	0,100	5,903
22.	Chinese beards (indici)	1,458±0,096	0,216	14,814
23.	Frost shape (indici)	1,246±0,102	0,229	18,378
24.	Spun fiber (indici)	1,776±0,098	0,220	12,387
25.	Wood density (g/cm^3)	0,558±0,020	0,046	8,243
26.	The total thickness of annual rings (mm)	34,648±1,020	2,282	6,586
27.	False heartwood (indici)	0,176±0,043	0,097	55,113

Phenotypic variation of quantitative characters of tree trunk for the first age group was generally medium except diameter 1.3 m, total height and stem volume which showed a wide variation. For the first age group interpopulațional variation of qualitative characters such as trunk forking, cylindric trunk, pruning, bark and rhitidom form was average variation coefficients hovering around 20%. Another character as trunk, bark color was much lower coefficient of variation of only 8,315%. The coefficients of variation obtained for rectitude trunk and torso form the basis were higher by 21,277% and 32,585%. Phenotypic variation widest observed for formal rhitidom coefficient of variation being 108,809%.

Regarding some characters crown is found for the first age group, symmetry crown that has a mean variation coefficient of variation not exceeding 20% (16,548%). In contrast to thick branches, the angle of insertion of branches and branch position variation recorded was low coefficients of variation obtained were 6,084%, 6,154% and 5,903%. A wide variation was recorded for characters crown diameter, crown height and crown shape vertical coefficients of variation being 21,201%, 36,198% and 20,986%.

Regarding the other characters of the tree trunk - to adapt characters such as Chinese beards and frost shape, they showed interpopulational variability average coefficients of variation not exceeding 20%.

Study of characters of timber trees such as fiber spun revealed an average phenotypic variation for this age group, and if wood density and total thickness of annual rings of a small change. Another character of the wood trees: false heartwood showed a large variation coefficient of variation being 55,113%.

Study interpopulational variation for 61-80 years age group and production classes indicate that there are three populations of the same class of production - II – 11-Gurahonț, 14-Mara and 16-Făget. This study revealed that the coefficients of variation were different from one character to another (Table 2).

Interpopulational variation of quantitative characters trunk was small diameter 1.3 m and height to the first branch ellagic for middle and high pruning overall height and trunk volume, with a coefficient of variation of 35,950%.For qualitative characters of the tree trunk there was an average interpopulational variation for most characters, except rectitude trunk that had a wide variation, with a coefficient of variation of 21.468% and rhitidom shape with a very wide variation and coefficient of variation of 154,736 %.

Phenotypic variation character crown was generally low, except crown diameter showed a middle variation coefficient of variation being

12,315% and symmetry crown with a large variation coefficient of variation being 21,363%.

Table 2

Statistical indicators of characters measured or observed in beech populations aged up to 100 years in the west - age group 61-80 years and production class II

No.	Character	$\overline{x}$ ±e	Σ	cv
1.	Diameter la 1,3 m (cm)	26,333±1,186	2,055	7,803
2.	Total height (m)	23,456±1,515	2,624	11,186
3.	The height to the first branch ellagic (m)	11,686±0,548	0,950	8,129
4.	Slenderness (Hm/Dcm)	0,946±0,095	0,165	17,441
5.	Trunk volum (m^3)	0,815±0,169	0,293	35,950
6.	Forking trunk (indici)	1,633±0,100	0,173	10,593
7.	Cylindric trunk (indici)	1,253±0,129	0,224	17,877
8.	Rectitude trunk (indici)	2,166±0,268	0,465	21,468
9.	Trunk shape base (indici)	1,943±0,144	0,250	12,866
10.	Pruning (indici)	1,546±0,153	0,265	17,141
11.	Bark color (indici)	1,900±0,115	0,200	10,526
12.	Shape color (indici)	1,100±0,085	0,147	13,363
13.	Rhitidom (indici)	1,110±0,095	0,165	14,864
14.	Rhitidom shape (indici)	0,190±0,170	0,294	154,736
15.	Crown diameter (m)	7,056±0,502	0,869	12,315
16.	Crown height (m)	11,876±1,310	2,269	2,265
17.	Vertical funnel shaped crown (indici)	3,376±0,186	0,323	9,567
18.	Symmetry crown (indici)	1,423±0,175	0,304	21,363
19.	Thick branches (indici)	1,643±0,046	0,080	4,869
20.	Insertion angle of branches (indici)	1,766±0,020	0,035	1,981
21.	Position branches (indici)	1,756±0,013	0,023	1,309
22.	Chinese beards (indici)	1,353±0,046	0,080	5,912
23.	Frost shape (indici)	1,133±0,088	0,152	13,415
24.	Spun fiber (indici)	1,836±0,166	0,288	15,686
25.	Wood density (g/cm^3)	0,556±0,037	0,065	11,690
26.	The total thickness of annual rings (mm)	33,980±0,626	1,085	3,193
27.	False heartwood (indici)	0,200±0,000	0,000	0,000

For other characters trunk - characters adaptation interpopulational variation was small for Chinese beards character and medium for frost shape character.

Some characters of timber trees showed a middle variation - spun fiber and wood density and total thickness of annual rings of a small change. For false heartwood there was no interpopulational variation.

If we make a comparative analysis of variance characters age groups, we find that in the 61-80 years group is distinguished 23-Mehadia people who have diameters and heights from 1,3 m higher than the general population (only the characters were plotted quantitative) (Figure 1), same population is noticed when the crown height and crown diameter, which exhibit higher values than the general population, with a production class superior to other populations (Figure 2).

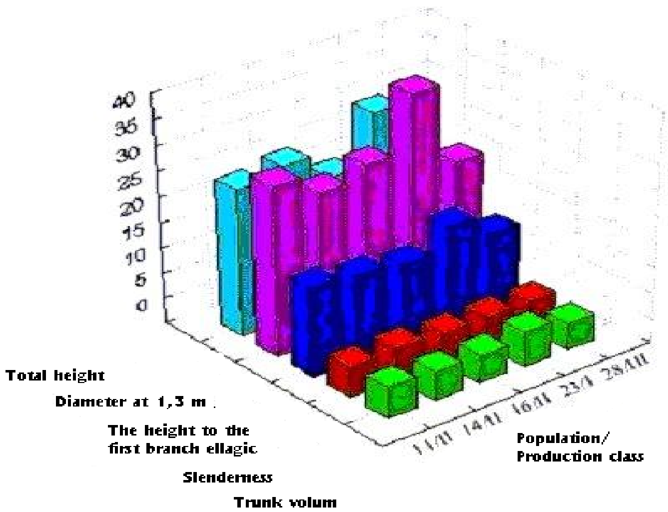

Figure 1. Variation in quantitative characters of the trunk on the population studied in the age group 61-80 years

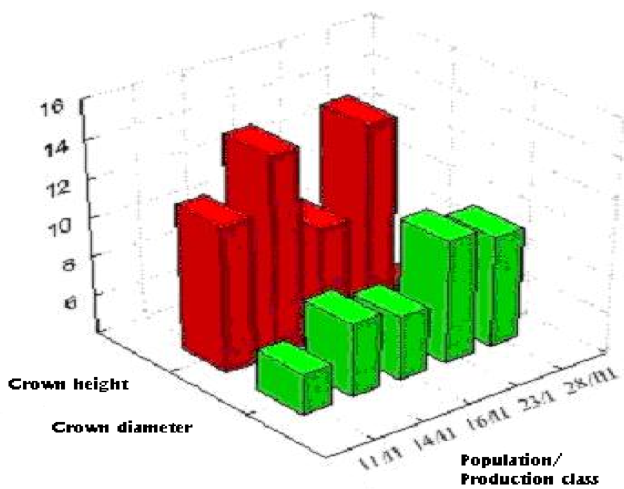

Figure 2. Variation characters crown on the population studied in the age group 61-80 years

To crown height high values were recorded for 14-Mara population and for above average crown diameter were observed for 28-Gilău population. Population 23-Mehadia presented values slightly above average for the experiment and the total thickness of annual rings (Figure 3). This population belongs to the harvest area F 340 - beech hill and vegetate at an altitude of 600 m, on soil type eutricambosoil.

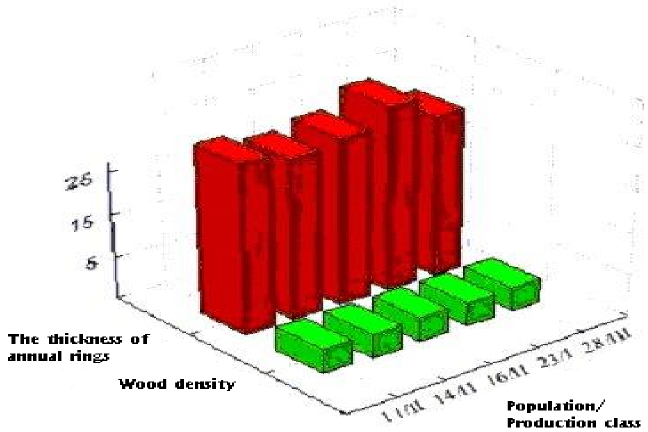

Figure 3. Variation of wood characters depending on the population studied in the age group 61-80 years

The other two populations that were awarded for this age group belong to other harvesting areas namely 14-Mara population in Zone A 120 - beech mixed forests with coniferous and population 28-Gilău area G 340 - beech hill. The altitudes at which they vegetate are also different, namely 14-Mara population grows at high altitudes above 1200 m, while the population increased 28-Gilău at altitudes between 520-850 m. In terms of soil type that the population is 28-Gilău increase on the same soil type as the population of 23-Mehadia - eutricambosoil, while 14-Mara population increases districambosoil soil type.

It was also noted that of the three populations with the same class of production - II – 11-Gurahonț, 14-Mara and 16-Făget stands as 11th Gurahonț population (Figure 4) for quantitative characters of the trunk and the wood, and 14-Mara population (Figure 5) with a force of growth and development of vegetation higher than the other two populations (all three populations of the same age), even if vegetate at a higher altitude class productivity of the resort is the same for these populations - middle 14-Mara population is favored by soil type which vegetate - districambosoil, while populations Gurahonț 11th and 16th Făget vegetate on a preluvosoil (Figure 6) (Ienciu , 2005).

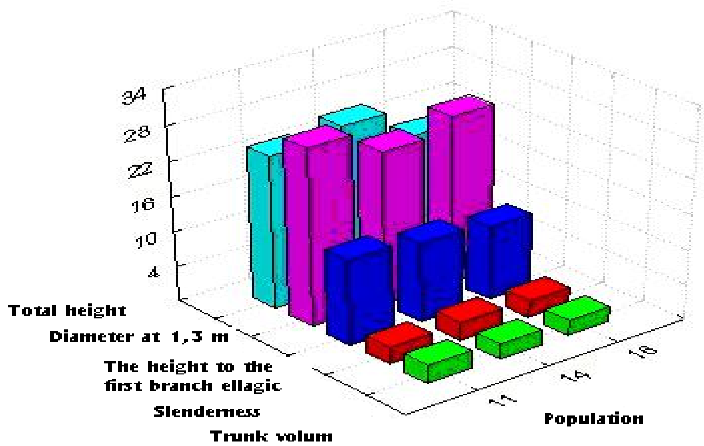

Figure 4. Variation in quantitative characters of the trunk on the population studied in the age group 61-80 years the production of Class II

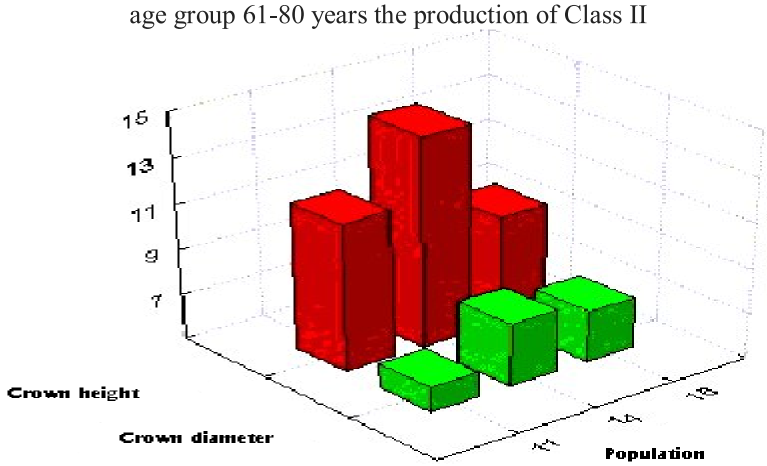

Figure 5. Variation characters crown on the population studied in the age group 61-80 years the production of Class II

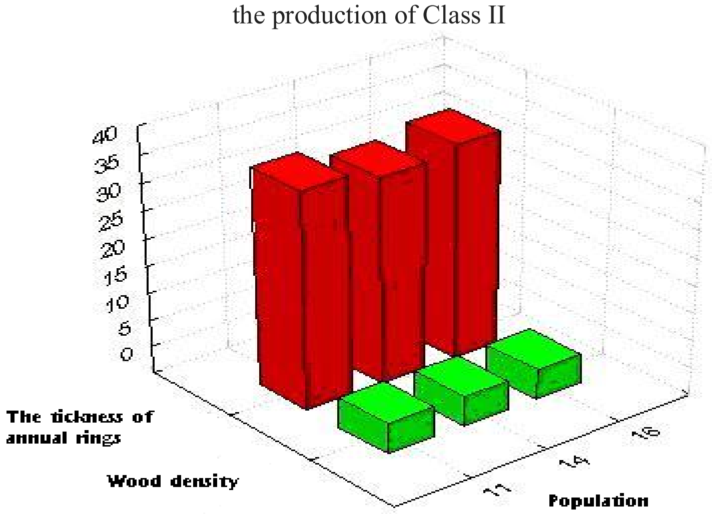

Figure 6. Variation of wood characters depending on the population studied in the age group 61-80 years the production of Class II

CONCLUSIONS

It was found that the interpopulational variation in all populations studied, was very different from one character to another, by age and production classes, this study is important for understanding the genetic heritage extremely valuable that we have this species trees.

The results of research conducted led to knowledge interpopulational variability of natural populations of beech, which in conjunction with the national and international literature will allow the development of a strategy of scientifically and tactics to be used in the improvement of phage in our country.

REFERENCES

1. Ceapoiu, N., 1968 – Metode statistice aplicate în experienţele agricole şi biologice, Ed. Agrosilvică, Bucureşti, p.550.
2. Ciobanu D., 2003, Genetică ecologică - Selecţia unor populaţii naturale valoroase de pin silvestru din Carpaţii Orientali şi Carpaţii de curbură, apte pentru cultură în staţiuni corespunzătoare din zonă, Editura Infomarket, Braşov, 133 p.
3. Enescu, V., Doniţă, N., Bândiu, C. et al., 1998 – Zonele de recoltare a seminţelor forestiere în R. S. România, Redacţia de propagandă tehnică agricolă, Bucureşti, p.61.
4. Ienciu Andra, Savatti M., 2004, Aspects regarding the existent correlations among different phenotipic characters studied on some natural beech stands (*Fagus sylvatica* L.) in the Western part of Romania, "3rd International Symposium – Prospects for the 3rd Millennium Agriculture", Buletinul U.S.A.M.V, vol. 61, Cluj-Napoca, pp.145-149, 489 p.
5. Ienciu Andra, 2005 – Cercetări de variabilitate în arborete naturale şi culturi comparative de fag (Fagus sylvatica L.) din vestul ţării, Teza de doctorat, Braşov, p.270.
6. Kent H., Weir B.S., 2009, Genetics in geographically structured populations: defining, estimating and interpreting FST, Nat Rev Genet. 10(9):639–650.
7. Mateescu G.D., 2005, Optimization by using evolutionary algorithms with genetic acquisitions, Romanian Journal of Economic Forecasting, no.2, pp.15-17.
8. Schneider P.M., 2011, Expansion of the European Standard Set of DNA Database Loci - the Current Situation. Profiles in DNA.;12(1):6-7.
9. Statistica, 1991 – Complet Statistical System, StatSoft, Inc.
10. Wade M.J., 2007, The co-evolutionary genetics of ecological communities, Nat.Rev. Genet. 8 (3): 185–95.