GENETIC VARIABILITY OF INDIGENOUS BIOTYPES HAZELNUT (*C. AVELLANA* AND *C. COLURNA* L.) FROM OLTENIA AND SOUTHERN TRANSILVANIA

VARIABILITATEA GENETICA A BIOTIPURILOR AUTOHTONE DE ALUN (*C. AVELLANA* SI *C. COLURNA* L.) DIN OLTENIA SI SUDUL TRANSILVANIEI

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Abstract. *The hazelnut (C.avellana and C. colurna) is a plant present in Romania, so that the crop and in the spontaneous flora, represented by populations, biotypes and cultivars. Hazelnut spread wide areas in Romania, but also their knowledge in certain micro-areas and taking into account the specific biological aspects (dichogamy emphasized, the need for pollination alogam) led to the formation of natural hybrids and finally biotypes with high genetic variability. This variability requires protection of "in situ" and "ex situ" to the phenomenon accentuated by erosion and genetic vulnerability, with negative effects on genetic resources.*
Key words*: hazelnut, biotype, genetic variability*

Rezumat. *Alunul (C.avellana si C. colurna) este o planta prezenta in Romania, atat ca planta de cultura cat si in flora spontana, reprezentata prin populatii, biotipuri si soiuri. Raspandirea alunului pe largi areale din Romania, dar si cunoasterea acestora in anumite microzone si tinand seama de unele aspecte biologice specifice (dichogamia accentuata, nevoia de polenizare alogama) au determinat formarea de hibrizi naturali si in final de biotipuri cu o mare variabilitate genetica. Aceasta variabilitate necesita protejarea "in situ" si "ex situ" fata de fenomenele accentuate de eroziune si vulnerabilitate genetica, cu efecte negative asupra resurselor genetice.*
Cuvinte cheie: *alun, biotip, varianilitate genetica*

INTRODUCTION

The hazelnut (*C.avellana* and *C. colurna*) is a plant present in Romania, so that the crop and in the spontaneous flora, represented by populations, biotypes and varieties.

The hazelnut plants existing in the spontaneous flora is stuck, especially in the hills, at an altitude of 90-100 m and shows interest in the identification of genotypes and to protect and preserve them for future generations, according to the International Union action for Conservation of Nature (IUCN), the FAO and Bioversity International (Bioversity, FAO and CIHEAM, 2008, Botu and Botu, 2000; Rovira, 1996; Vicol, 2010).

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Collecting hazelnut genetic resources (populations, biotypes, older varieties) is a high-action scientific and economic importance and of interest to develop this culture based on new varieties possessing some valuable genes adapted to the specific conditions of our country.

The identification, collection and evaluation are related to the storage and subsequent use.

Hazelnut spread wide areas in Romania, but also their knowledge in certain micro-areas and taking into account the specific biological aspects (the dichogamy emphasized, need for alogam pollination) led to the formation of natural hybrids and finally biotypes with high genetic variability. This variability requires protection of "in situ" and "ex situ" to the phenomenon accentuated by erosion and genetic vulnerability, with negative effects on genetic resources.

Consequently, we intend to identify, collect, evaluate and the conservation of some biotypes of hazelnut in southern Transylvania and Oltenia.

MATERIAL AND METHOD

In southern Transylvania and Oltenia formed hazelnut numerous biotypes belonging to *C. avellana* and *C. colurna* even on the edge of deciduous forests and along rivers and streams.

In these areas, between 2008-2011, was identified a total of 37 biotypes. Among these are three biotypes of *C. avellana* x *C. colurna* origin.Biotypes were evaluated "in situ". All plants studied are aged over 20 years.

Observations and measurements were related to the behavior in the growth process (force the type of growth suckering capacity, etc.) and in the process of fructification (index size and average fruit weight, index round exocarp thickness, strength fruit breaking, shape and color of the fruit etc). At each biotype were measured 25 fruits.

Remark and measurements were within the descriptors Bioversity International and local positioning identification was performed using GPS.

RESULTS AND DISCUSSIONS

Identification of biotypes of hazel (37) was made in southern Transylvania and Oltenia with GPS, specifically in an area located between parallels $44^0$47 'N and $45^0$81' N and meridians $23^0$38'E and $24^0$81 'E. The area covered several localities in the counties of Dolj, Valcea, Gorj, Hunedoara and Brasov (Table 1).

Biotypes from *C.avellana* (34) *C.colurna* natural interspecific hybrids (*C.avellana* x *C.colurna*).

Between Mehedinti and Gorj is a natural forest formed from natural hybrids, the dominant character of *C. colurna*.

Biotypes identified wide variability shows character growth and fructification.

Plant growth vigor of mature (over 20 years) is generally average, except biotypes from *C.colurna* which shows a large effect (plants and tree heights over 8.0 m).

Table 1

Place identification of *C. avellana* and *C. colurna* hazelnut biotypes

No.	Accession	Species	Place identification	Latitude	Longitude
1	A1-1-2008	C.avellana	Rou-Valcea	$44^0$85’	$24^0$23’
2	A1-2-2008	C.avellana	Rou-Valcea	$44^0$85’	$24^0$23’
3	A1-3-2008	C.avellana	Rou-Valcea	$44^0$85’	$24^0$23’
4	A1-4-2008	C.avell xcol	Rou-Valcea	$44^0$85’	$24^0$23’
5	A1-5-2008	C.avell xcol	Rou-Valcea	$44^0$85’	$24^0$23’
6	AM -13-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
7	AM-14-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
8	AM-15-2008	C.avelana	Rou-Valcea	$45^0$35’	$24^0$33’
9	AM-16-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
10	AM-17-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
11	AM-18-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
12	AM-19-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
13	AM-20-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
14	AM-21-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
15	AM-22-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
16	AM-23-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
17	AG-1-2008	C.avellana	Rou-Gorj	$44^0$72’	$24^0$33’
18	AG-2-2008	C.avellana	Rou-Gorj	$44^0$72’	$23^0$08’
19	AM-1-2008	C.avellana	Rou-Valcea	$45^0$35’	$23^0$08’
20	AM-2-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
21	AM-3-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
22	AM-4-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
23	AM-5-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
24	AM-6-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
25	AM-7-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
26	AM-8-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
27	AM-9-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
28	AM-10-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
29	AM-11-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
30	AM-12-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
31	AM-24-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
32	AM-25-2008	C.avellana	Rou-Valcea	$45^0$35’	$24^0$33’
33	ANB-2008	C.avellana	Rou-Valcea	$45^0$12’	$24^0$45’
34	AF-2008	C.avellana	Rou-Brasov	$45^0$81’	$24^0$81’
35	AV1-2008	C.avellana	Rou-Dolj	$44^0$47’	$23^0$92’
36	AV2-2008	C.avellana	Rou-Dolj	$44^0$47’	$23^0$92’
37	AP-2009	C.colurna	Rou-Hunedoara	$45^0$41’	$23^0$38’

Type of plant growth is in the form of bush (*C. avellana*) from the displayed semierect. Biotypes of *C. colurna* oscillates between semietalat (A1-4-2008) and erect (AP-2009). Most biotypes shows a large number of suckers / plant (13-36 pieces), except biotypes *C.avellana* x *C.colurna* not suckers.

Biotypes identified in the spontaneous flora shows a very low capacity fruition (0,2-2,5 kg / plant), which according to both the plant genotype and the position within the biotype. Fruit characteristics are defining elements of differentiation between biotypes (Table 2 and 3).

Table 2

The main characteristics of the fruit of hazelnut biotypes

No.	Accession	Fruit size index (mm)	Average weight (g)	Round index	Fruit shape	Exocarp thickness	Exocarp break
1	A1-1-2008	18,9	2,4	1,1	Globular	1,9	Hard
2	A1-2-2008	18,2	2,2	1,2	Flat globular	1,7	Hard
3	A1-3-2008	18,8	2,3	1,1	Flat globular	1,8	Hard
4	A1-4-2008	15,5	1,5	0,8	Short subcylindrical	1,7	Hard
5	A1-5-2008	15,1	1,4	0,8	Short subcylindrical	1,6	Hard
6	AM-13-2008	16,3	1,9	0,7	Short subcylindrical	1,8	Hard
7	AM-14-2008	14,6	1,4	0,7	Short subcylindrical	1,7	Hard
8	AM-15-2008	14,9	1,6	0,8	Globular	1,8	Hard
9	AM-16-2008	14,0	1,2	0,7	Globular	1,7	Hard
10	AM-17-2008	15,6	1,6	0,7	Globular	1,9	Hard
11	AM-18-2008	15,8	1,7	0,7	Globular	1,7	Hard
12	AM-19-2008	14,0	1,3	0,8	Globular	1,8	Hard
13	AM-20-2008	16,3	1,9	0,8	Short subcylindrical	2,0	Hard
14	AM-21-2008	15,2	1,5	0,8	Short subcylindrical	1,9	Hard
15	AM-22-2008	13,3	1,0	0,7	Short subcylindrical	1,7	Hard
16	AM-23-2008	15,3	1,5	0,7	Short subcylindrical	1,8	Hard
17	AG-1-2008	13,7	1,3	0,8	Short subcylindrical	1,8	Hard
18	AG-2-2008	13,8	1,3	0,8	Short subcylindrical	1,6	Hard
19	AM-1-2008	16,1	2,7	0,7	Ovoid	1,9	Hard
20	AM-2-2008	15,2	1,6	0,7	Ovoid	1,7	Hard
21	AM-3-2008	14,9	1,5	0,9	Globular	1,6	Hard
22	AM-4-2008	14,8	1,5	0,8	Globular	1,9	Hard
23	AM-5-2008	13,7	1,2	0,7	Long subcylindrical	1,6	Hard
24	AM-6-2008	18,1	1,4	1,2	Globular	1,8	Hard
25	AM-7-2008	13,4	1,0	0,6	Long subcylindrical	1,9	Hard
26	AM-8-2008	15,9	1,7	0,8	Short subcylindrical	1,5	Hard
27	AM-9-2008	15,3	1,7	0,8	Short subcylindrical	1,6	Hard
28	AM-10-	13,8	1,2	0,7	Long	1,7	Hard

	2008				subcylindrical		
29	AM-11-2008	16,2	1,7	0,6	Long subcylindrical	1,9	Hard
30	AM-12-2008	14,3	1,8	0,8	Short subcylindrical	1,8	Hard
31	AM-24-2008	15,7	1,6	0,8	Short subcylindrical	1,8	Hard
32	AM-25-2008	13,9	1,2	0,7	Short subcylindrical	1,6	Hard
33	ANB-2008	13,5	1,1	0,9	Globular	1,6	Hard
34	AF-2008	14,7	1,0	0,8	Ovoid	1,5	Hard
35	AV1-2008	14,5	1,4	0,7	Ovoid	1,6	Hard
36	AV2-2008	14,5	1,4	0,9	Globular	1,5	Hard
37	AP-2009	15,8	1,7	0,7	Globular	1,7	Hard

Fruit size index is between 13.3 and 18.9 mm, with an overall average of 15.2 mm. fruits fall in small and medium class. Standard deviation (3.80 mm) and coefficient of variation (25.0%) have high values, indicating that differences between the size biotypes are high. Measured by the same statistical indicators each biotype (s and s%) showed that they are much smaller (s = 1.0-1.8% and s = 8-12), the fruit is smooth. Average weight of fruit to hazelnut biotypes is 1.55 g (lightweight class) and oscillation between biotypes ranged between 1.0 and 2.4 g. standard deviation (0.39 g) and coefficient of variation (25.2%) were large differences between fruit weight biotypes are appreciated. In the same biotype these indicators are much lower (s = 0.18-0.21% and S = 9.4 to 13.5%).

Some biotypes (A1-1-2008, A1-A1 2-2008 and 3-2008) shows the indices of average fruit size and weight that fits in middle class (18.2 to 18.9 mm and from 2.2 to 2,4g). Hazelnut round fruit are rated for industrial processing industry (peeling may be mechanized). Biotypes identified shows generally elongated fruit (Ir = Ir = 0.6-0.8 and 1.0-1.2), only 3 of them have fruit globular or spherical (Ir = 0.9 to 1.0). Mean round index is 0.8, with s = 0.24 and s = 30.0%, indicators that show a high degree of variability.

For each biotype, round index shows s% lower (below 10%) with a low variability.Average thickness of 1.75 mm exocarp with amplitude between 1.5 and 2.0 mm, which looks like peanuts to biotypes studied shows a very thick skin and tough enough. Differences between the fruit exocarp thickness is reduced (s = 0.28 mm and s = 16%). S% compared to values within each biotype it is huge (s% = 6-8%).Differences between biotypes register and fruit color, cross-sectional shape of the fruit, the fruit tip shape, fruit shape, etc. The hazelnut biotypes were found to be resistant to *Botrytis cinerea*, with a variation of 1.2% in the frequency of attacks (MA-19-2008, I-14-2008, I-15-2008) and 7.3% (AM-20-2008), the *Phytoptus avellanae* (not present attack) and *Balaninus nucum* (frequency of 1.2 to 5.1%). Their strength is far superior cultivated varieties.

Table3

Variability of fruit charactaristics of some biotypes of wild hazelnut

Specifications	U/M	Val. min.	Val. max.	Amplitude	Val. medium	s	s%
Size index	mm	13,3	18,9	6,6	15,2	3,80	25,0
Fruit weight	g	1,0	2,4	1,4	1,55	0,39	25,2
Round index	-	0,6	1,2	0,6	0,8	0,24	30,0
Exocarp thickness	mm	1,5	2,0	0,5	1,75	0,28	16,0
Fruit colour	-	Yellowish	Brown	-	-	-	-
Fruit transversal section shape	-	Elliptic	Round	-	-	-	-
Apex fruit shape	-	Sharpening	Flat	-	-	-	-
Curvature basal scar fruit	-	Convex	Smooth	-	-	-	-
Fruit shape	-	Long subcylindrical	Globular	-	-	-	-
Exocarp break	-	-	Hard	Hard	-	-	-

CONCLUSIONS

In spontaneous flora of southern Transylvania and Oltenia 37 biotypes were identified by *C. avellana* and *C.avellana* x *C.colurna* which shows great variability in growth and fruiting characteristics. Plant growth form of tufa, of medium size and shape to semispred et al. Interspecific biotypes exception of *C. colurna* with a big increase with one trunk.

Biotypes of *C.avellana* shows many suckers in the bush (13-36 units/plant). Fruits of hazelnut biotypes shows a large variability on fruit size index (13.3 to 18.9 mm), average fruit weight (1.0 to 2.4 g), round index (0.6-1.2), exocarp thickness (1.5-2.0 mm), etc. High variability in fruit descriptors from hazelnut biotypes results from determinations indicators dispersion (standard deviation and coefficient of variation), which shows high values.

All hazel identified biotypes resistant to some diseases (*Botritis cinerea*) and pests (*Phytoptus avellanae* and *Balaninus nucum*) variable, but superior varieties of culture. Hazelnut biotypes are possessors of genes of interest for breeding programs and conservation needs for the future.

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