# DISTRIBUTION OF FROST CRACKS LENGTH IN RELATION TO COMPASS POINTS AND BIOLOGICAL ORIGIN OF TURKEY OAK WITHIN BOBOSTEA FOREST (COUNTY OF BIHOR)

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#### Abstract

This paper presents the results of research conducted on the Turkey oak species within the sampling areas located in Bobostea forest (Bihor county,Romania) and in other locations (Forest District Tasnad and Forest District Dumbrava-Beliu), which allowed us to draw some conclusions about the distribution of frost cracks length and the biological origin of Turkey oak trees within the studied area.

We identified a total of 578 frost cracks in the case of the total 742 trees analyzed.

Keywords: frost crack, compass points, biological origin, Turkey oak trees

### **INTRODUCTION**

Frost crack (split) is a radial crack of the tree trunk (see Picture 1 below), occurring throughout the trunk, in some cases showing a helical route (it may go in depth to pith of the tree), it is usually present in deciduous species (i.e. **Turkey oak**, Sessile oak, Oak tree, Common walnut, European ash, elm, maple, poplar), and it is rarely met on conifers; according to some scholars, it occurs in the winter because of tensions caused by wood shrinkage when sudden and sharp temperature decrease occurs (e.g. ranging from-10°C....- 20°C), and it is usually formed at the base of the trunk (Giurgiu & Decei, 1997; Dinulică, 2007; Beldeanu, 2008).

According to some authors (Vallée, 2002, quoted by Dinulică, 2007) in the case of the Sessile oak and Oak tree, the frost crack mainly affects specimens growing on soils with acid humus, coarse texture and clay located near the surface.

Filipovici (1964) considers that frost crack is common in trees with irregular and eccentric growth (species which are located at the northern limit of vegetation) or in the case of trees located in special microclimates (frost holes) and occurs frequently in the case of species with very fusible timber.

Trees sensitivity to frost and therefore the occurrence of frost cracks can be caused by land exposure, and cardinal directions South and North having a decisive impact on the distribution of frost cracks on the circumference (girth) of beech (Câmpu, 2008) and birch trees (Kula et al, quoted by Câmpu, 2008).



Picture 1. Several frost cracks on a Turkey oak sample (compartment 87C, management unit VII, Bobostea forest)

In order to estimate frost cracks, one measures their depth (at the end of round timber), width (all on the same end) and the length of the wood side. Frost crack is expressed either in units of length or in parts (sections) of the appropriate size of timber (Beldeanu, 1999, 2008).

# MATERIAL AND METHOD

In the investigated area (i.e. Bobostea forest) and in order to characterize the wood quality of Turkey oak trees, a total of 14 sampling areas of variable size (i.e. 2000-2400 m<sup>2</sup>) were established; measurements and observations were carried out at a number 613 Turkey oak sampling trees (\*\*\*, 1983, 1997). For comparison purposes, two sample surfaces of 2000 m<sup>2</sup> were established in Tasnad Forest District (Satu Mare county), where a total number of 51 Turkey oaks sampling trees were measured and observed, and two sample surfaces of 2000 m<sup>2</sup> were established in Dumbrava - Beliu Forest District (Arad county), where a total number of 78 Turkey oaks sampling trees were measured and observed too (\*\*\*, 2003, 2005). On the whole, 742 Turkey oak sampling trees were measured within the 18 test areas (Bartha Sz., 2011).

In order to characterize the standing trees there were developed and filled in forms for all trees identified (Dinulică, 2009). Forms contain an index of 40 qualitative and quantitative characteristics for each tree. In order to characterize variables (alternative and discrete) scale parameters were adopted. The index of characteristics includes (Bartha Sz., 2012) as follows:

1. *Presence and location of frost crack* determined according to the following scale:

**0**-no frost crack, **1**-with frost crack in the  $1^{st}$  class quality section of the tree (0-6 m); **2**-with frost crack in of the  $2^{nd}$  quality section (from 6 m height up to the first green branch); **3**-with frost crack on the intermediate section.

2. *Frost crack type* established with the naked eye: **1**-right frost crack, **2**-twisted frost crack.

3. *Frost crack size* (m), measured as gap between the ends of the tree sections affected;

4. *Number of frost cracks per tree*, determined with the naked eye: **0**-no frost cracks, **1**-with one frost crack, **2**-with two frost cracks, **3**-with three frost cracks, **4**-with four frost cracks, **5**-over four cracks.

5. Frost crack orientation relative to the main compass points, determined

using a magnetic compass, manufactured by IOR Bucharest, model B1-69;

6. Relative length (%) of the tree stem section affected by frost crack, determined as a ratio between the length of the tree section affected by frost crack and tree height.

Desk work consisted in processing and interpretation of data collected in the field; data were centralized by biological origins and diameter classes (Chiţea, 1997; Leahu, 2004; Dorog, 2008). Mathematical processing of data was done in STATISTICA software version 8.0 and Excel (Bica et al., 2006).

### **RESULTS AND DISCUSSIONS**

Distribution of frost cracks by lengths and compass points categories closely follows the distribution by compass points, meaning that the distribution is decreasing starting from smaller length frost crack classes and ending with higher length frost crack classes (see Table 1 and 2 below).

Table 1

	Compass points									
Frost cracks length classes (m)	East		North		South		West		Total	
	Seed	Shoot	Seed	Shoot	Seed	Shoot	Seed	Shoot	Seed	Shoot
1	11	14	24	36	26	35	9	27	70	112
2	6	11	20	24	24	28	19	12	69	75
3	6	7	14	15	17	17	8	8	45	47
4	4	5	6	14	9	13	9	2	28	34
5	3	2	1	6	9	9	2	3	15	20
6	2	2	5	4	4	3	3	4	14	13
7	2	0	4	3	4	1	1	2	11	6
8	2	0	1	3	2	2	0	0	5	5
9	0	0	1	1	0	0	0	0	1	1
10	0	0	1	0	0	2	2	0	3	2
11	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	1	0	0	0	1
15	0	0	0	0	0	0	1	0	1	0
Total	36	41	77	106	95	111	54	58	262	316

Distribution of frost cracks by lengths, compass points and origins classes

The trees from the shoots within the same length class are generally affected by a larger number of frost cracks as against those originating from seed.

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Frost cracks		Comp	ass points		Total		
length classes							
( <b>m</b> )	Е	Ν	S	V	Number of frost cracks	%	
1	25	60	61	36	182	31.5	
2	17	44	52	31	144	24.9	
3	13	29	34	16	92	15.9	
4	9	20	22	11	62	10.7	
5	5	7	18	5	35	6.1	
6	4	9	7	7	27	4.7	
7	2	7	5	3	17	2.9	
8	2	4	4	0	10	1.7	
9	0	2	0	0	2	0.3	
10	0	1	2	2	5	0.9	
11	0	0	0	0	0	0.0	
12	0	0	0	0	0	0.0	
13	0	0	0	0	0	0.0	
14	0	0	1	0	1	0.2	
15	0	0	0	1	1	0.2	
Total	77	183	206	112	578	100	

Distribution of frost cracks by lengths classes and compass points

Determination in % of differences between the number of frost cracks by length classes between the two biological origins shows that such differences vary between 10-100%; however the smallest differences are recorded in the case of frost cracks length classes 1, 2, 3 and 4 (See Chart no. 1 below).

If analyzed by compass points, these differences (expressed as a percentage) are higher on the north direction, i.e. roughly 16% more frost cracks occur on trees from shoots than on those from seed as biological origin.

On the East and South directions, the differences (%) are approximately equal, i.e. 6.5% and 7.8% respectively, while on the West direction there are recorded the smallest differences i.e. 3.6%.

In terms of number of frost cracks by length classes, there is a percentage of 31.5% and 24.9% respectively, which means that more than 50% of frost cracks length range between 1-2 m.

For frost cracks length classes 3 and 4, the percentages are 15.9% and 10.7%, respectively, the remaining frost cracks length classes where length are > 5 m are less than 10%.

Frost cracks lengths classes > 9 m do not exceed 1%.



by compass points and biological origin

# CONCLUSIONS

- For trees originating from shoots, the percentages of frost cracks by length classes are higher than in the case of trees derived from seed, for all compass directions i.e. north, south, east and west;
- More than half of frost cracks have lengths ranging between-2 m.
- Most frost cracks appear on the compass point south (206 frost cracks) and north (183 frost cracks), which confirms other authors' research conducted on other species (e.g. beech).

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