A REPORT OF BEECH BARK NECROTIC DISEASE IN NORTHERN ROMANIA

IVAN MIHÁL and ALOJZ CICÁK

Institute of Forest Ecology, Slovak Academy of Sciences, Štúrova 2, Zvolen, SK - 960 53, Slovakia
mihal@sav.savzv.sk

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In this paper we present the results of a research on occurrence of necrotic disease on beech stems at four selected localities in northern Romania. The results, expressed through the necrotisation index (I_{SN}) ranged from 0.83 to 1.31. The I_{SN} values are comparable with the values obtained at six localities in Bulgaria. The I_{SN} from Hungary ranged from 1.11 to 1.18. The values of I_{SN} from 54 localities in Slovakia were within 0.53–1.97. The values comparable with the localities Telciu, Holda and Crucea were in Slovakia found only for twelve of the 54 localities. The species *Nectria cinnabarina* was identified at the localities Crucea and Piatra Fantanele, the species *Nectria coccinea* at the localities Holda and Piatra Fântânele and *Nectria galligena* at Holda and Telciu. We observed a zero frequency occurrence in the butterfly *Ectoedemia liebwerdella*. In Bulgary, the frequency occurrence of this butterfly ranged from 4% to 97%. In Slovakia it was from 1% to 100%. Also in case of *Bucculatrix ulmella* was the dominance found in Romania evidently lower than the values obtained in Bulgaria and Slovakia.

Key words: Beech; *Fagus sylvatica* L.; Necrotic disease; Northern Romania.

INTRODUCTION

In recent years, necrotic disease of beech trees in Europe has been turned to a serious problem in context of plant pathology, forest management and landscape ecology. In countries of central and south-eastern Europe, the disease has locally reached the stage of epiphytocia. The necrotic disease has become a research subject for scientific teams in Poland[13,20], the Czech Republic[11], Slovakia[4,5,14,16], Ukraine[10], Hungary[16], the former Yugoslavia[12], Romania [7,8,9,17] and Bulgaria [6,18].

In this paper we present the current results obtained in evaluation of necrotic damage degree to beech stands for four localities in northern Romania. Our objective was to fill the gap in our hitherto obtained data on beech necrotic disease in south-eastern Europe.

MATERIALS AND METHODS

We conducted the research in beech stands at four selected localities in northern Romania in days from 17.10.2006 – 19.10.2006. The short description of the sites is in Table 1. At each locality we evaluated in the selected stand 100 trees belonging to the tree class 1–5 (according to Kraft), with the aim to map the entire vertical stand profile. The evaluation of the beech bark necrotic disease was made according to the evaluation scale elaborated by the authors of this paper [2,3].

To obtain a simplification of interpretation of the results, the evaluation has been performed using the so-called bark necrosis index (I_{SN}). Each of the data represents the mean degree of the injury (computed as the weighed arithmetical mean) for each individual tree class. More details concerning the computation and usage of the I_{SN} index are given in the author's paper [3].

Significance of differences in necrotic disease of beech stem expressed by I_{SN} between individual study plots was tested by Mann-Whitney *U* test. We choose this test because of non-parametric character of data resulting from discrete values used in the evaluation scale.

To assess the degree of necrotic damage to beech stems we also sampled fruiting bodies of fungi of the genus *Nectria* (Fr.) Fr. They were present most frequently on the bark of stems damaged by necrosis and also on broken and lying stems. The sampled fruiting bodies of the genus *Nectria* (Fr.) Fr. were determined in the laboratory according to the determination keys provided by abroad authors [1,19].

Table 1

Basic characteristics of the individual localities

Characteristics	Localities			
	Telciu	Crucea	Holda	Piatra Fantanale
Orographic formation	Munţii Tibleş	Munţii Bistriţei	Munţii Stânişoarei	Munţii Bârgau
Location	N – 47°26′ E – 24° 22′	N – 47° 15′ E – 25° 39′	N – 47° 19′ E – 25° 37′	N – 47° 13′ E – 24° 57′
Exposition	E	NE	SW	E
Altitude (m a.s.l.)	420	650	690	1020
Average (years)	60–100	30–120	30–100	80
Parent rock	sandstones, flysh	schists,	schists,	sandstones,
	0.8	fylits	fylits, silica	flysh
Stocking	30°	0.8	0.9	0.7
Slope	beech 90%,	25°	15°	30°
Tree composition	hornbeam 7%	beech 95%,	beech 95%,	beech 97%,
	maple 3%	spruce 5%	linden 2%,	maple 2%
			maple 2%,	spruce 1%,
			elm 1%	

Classification scale for bark necrosis evaluation on beech stems

Degree	Characteristics
0	Without any necrotic wounds on the bark
1	Small necrotic wounds (bark fissures, cracks) occurring singularly or in individual groups , Visible only with closer examination of the stem
2	Small necrotic wounds (as for the degree 1) accompanied by occurrence of larger necrotic Wounds (larger fissures, rugged bark) visibly under ordinary examination of the stem
3	Larger necrotic wounds denuding the xylem and partly deforming the stem, bark cracking and shedding, visible already from a larger distance
4	Large necrotic wounds deforming the stem heavily or leading to ”bark necrosis”, rugged bark and bark shedding, visible also from greater distance

Note: A stem, from buttresses to the crown setting, in an evaluated part of the tree. It is necessary to consistently distinguish in the process of evaluation occlusions after bark injury from logging, after game browsing and frost cracks from necrosis of tracheomycotic type. Neither the number of necrotic lesions nor the size of the stem bark area covered with necroses in taken as the main indicator during evaluation. Destructive effects of necrotic disease are manifested mainly by the stages of necrosis development precised in the classification scale description.

Together with the assessment of the degree of necrotic damage we also recorded the occurrence of biotic vectors of the disease: *Cryptococcus fagi* Bären sp., *Bucculatrix ulmella* Zeller and *Ectoedemia liebwerdella* Zim. The presence was identified from the buttresses to a height of 2 m around the whole stem perimeter.

RESULTS AND DISCUSSIONS

The grade of necrotic damage to beech trees expressed with the values of necrotisation index (I_{SN}) for the individual localities is presented in Table 2. Comparing the mean values of I_{SN} between the individual localities we can see that the localities Telciu, Holda and Crucea show almost the same results and, from the viewpoint of mathematical statistics, they represent one homogeneous group. The mean value of frequency occurrence of necrotic damage in degree 0 was 32.7 %, in the other degrees 1 to 4 it was 67.3%. There were found conspicuous, statistically significant differences in I_{SN} values between each of these localities and the locality Piatra Fântânele ($p < 0.05$). The damage at Piatra Fântânele in degree 0 was found 3× less frequent, on the other hand, there were 2× more trees damaged in the degree 2 (Table 2).

To identify the cause of the significantly higher I_{SN} value at the locality Piatra Fântânele means to perform a more detailed analysis of site conditions and to compare them with the other localities. We can hypothesise about the high altitude (1 020 m a.s.l.) and the associated less favourable climatic conditions. Another cause can be the outbreak of the leaf-consuming bug *Rhynchaenus fagi* L. in this locality. This bug is considered to be a transfer vector for tracheomycotic disease in forest woody plants,[14] and it has not been recorded at the other localities. The third cause of the less favourable health state of beech trees at the locality Piatra Fântânele can be the fact that the stand was established by coppicing.

Table 2

Frequency of necrotisation and index of beech bark stem necrotisation (I_{SN}) in selected localities

Locality	Frequency of necrotisation in individual necrotisation degrees [%]								I_{SN} (mean ± standard error)
	0	1	2	3	4	1–4	2–4	3–4	
Telciu	32	58	6	2	2	68	10	4	0.84 ± 0.11 [a]
Holda	33	55	8	4	0	67	12	4	0.85 ± 0.07 [a]
Crucea	33	55	9	2	1	67	13	3	0.83 ± 0.08 [a]
Piatra Fântânele	11	62	17	5	5	89	27	10	1.31 ± 0.09 [b]

Statistical significance of differences in I_{SN} between localities is marked by *a* and *b*

The closest situated to Romania is Bulgaria and Hungary where we used the same method for obtaining the I_{SN} values. The I_{SN} values from the six localities in Bulgaria ranging from 0.72 to 1.12 are comparable with the values obtained in northern Romania.[6] The I_{SN} values in Hungarian territory were higher, ranging from 1.11 to 1.18.[16] The same method was used for the I_{SN} examination in 54 Slovak localities where we obtained an interval of 0.53 to 1.97.[5] The values from Romania were only in one case (locality Piatra Fântânele) higher than the average value for the whole Slovak territory (I_{SN} = 1.22). The values comparable with the localities Telciu, Holda and Crucea were in Slovakia found for twelve of the 54 examined localities.

Several authors suggest about an increase in necrotic damage to beech trees in Romania caused by parasitic fungi of the genus *Nectria.* [7,8,9,17] The authors mean that the factors launching most frequently the necrotic disease comprise: unfavourable soil conditions, unfavourable age structure and species composition, unfavourable climatic factors (water deficit and spring frost). These unfavourable conditions promote dispersal of fungi of the *Nectria* [7,8,9] genus. The study of biotic pests in Romanian forest stands revealed that 80% of the evaluated trees were infected with fungi of the genus *Nectria* [17].

In our research in northern Romania we determined the following species of the *Nectria* genus: *Nectria cinnabarina* (Tode) Fr. at the localities Crucea and Piatra Fântânele, *Nectria coccinea* (Pers.) Fr. at the localities Holda and Piatra Fântânele and the species *Nectria galligena* Bres. ex Strasser at the localities Holda and Telciu.

The results of monitoring of three selected biotic vectors for necrotic disease are summarised in Table 3. Surprising was the zero occurrence of the butterfly *Ectoedemia liebwerdella*. The dominance of this butterfly at six Bulgarian localities in the Stara Planina Mts. ranged from 4 % to 97 %, with the highest values connected with low altitides.[6] Similarly, in Slovakia, the dominance of *Ectoedemia liebwerdella* at 23. from 40 examined localities ranged from 1% to 100%.[14] Also in case of *Bucculatrix ulmella*, the dominance of the species was found markedly lower in Romania than in Bulgaria and Slovakia.

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Table 3

Frequency occurrence (%) of biotic vectors of beech necrotic disease on selected localities

Localities	Altitude (m a.s.l.)	*Cryptococcus fagi*	*Bucculatrix ulmella*	*Ectoedemia liebwerdella*
Telciu	420	98,0	0.0	0.0
Holda	660	90.0	2.0	0.0
Crucea	690	77.0	3.0	0.0
Piatra Fântânele	1020	99.0	1.0	0.0

Bucculatrix ulmella Zeller – pupae, *Cryptococcus fagi* Bärensp. – colonies of adult individuals, *Ectoedemia liebwerdella* Zimm. – galleries in bark after mining.

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