# OCCURENCE OF CHESTNUT BLIGHT FUNGUS IN UKRAINA IN THE LAST DECADE

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***Abstract***
*Chestnut blight caused by the Cryphonectria parasitica (Murrill) Barr [syn.: Endothia parasitica (Murr.) P.J. Anderson and H.W. Anderson ] fungus is one of the major pathogen for Castanea species. At the end of the XIX. th. Century, the fungus was introduced into the USA from the Asia and spread within the next five decades throughout all the main chestnut areas. C. parasitica was identified first in North America in 1904, when symptoms were observed on American chestnut [Castanea dentata (Marsh) Borkh] and destroyed almost the whole North American chestnut populations). In 1938, the fungus was discovered in Europe, in Italy on European chestnut (Castanea sativa). In the next decades the fungus spread throughout the most important chestnut growing areas of Europe and at the end of the last century most parts of Europe were affected by the pathogen, including the Carpathian-Basin. Chestnut blight symptoms were reported first on chestnut in Hungary in 1969. In 1998 blight symptoms were also detected on some young sessile oak (Quercus petraea) trees in Hungary. Goals of our studies were to examine the presence of Cryphonectria parasitica in Ukraine on European chestnut and on oaks. Field examinations were started in Ukraine in 2001. Symptoms of C. parasitica were detected on chestnut trees on two chestnut populations (Seredne, Bobovisce). Latest field examination was done on 27. 07. 2009. Cryphonectria parasitica fungus were found on three chestnut growing areas (in those populations what were infected earlier). The infection ratios were higher in 2009 than earliar (I% -35-98). The infection indexes were also higher (Ii -2,00 – 4,20). Laboratory examinations showed that the isolates origined from the Ukrainian test sites were virulent. 2 different VC types of the pathogen (EU-12 and EU-13) were identified. Oak trees were also examined in Ukraina, but infected oak trees by Cryphonectria parasitica were not found up today.*

**Keywords**: chestnut blight, *Cryphonectria parasitic*a, *Castanea sativa*, blight symptoms, VCG-s,.

## INTRODUCTION

Chestnut blight caused by the *Cryphonectria parasitic*a (Murrill) Barr [syn.: *Endothia parasitica* (Murr.) P.J. Anderson and H.W. Anderson ] fungus is one of the major pathogen for *Castanea* species. The fungus was introduced into the USA from the East-Asia at the end of the XIX. th. century and spread within the next five decades throughout all the main chestnut areas. *C. parasitica* was identified first in the USA in 1904, when lesions and necrosis were observed on trunk and branches of the American chestnut [*Castanea dentata* (Marsh) Borkh] and destroyed almost the whole North American chestnut populations (Anagnostakis, 1987). In 1938, the pathogen was first discovered in Europe near Genova, Italy on European chestnut (*Castanea sativa*) (Biraghi, 1946). Than the fungus spread rapidly throughout the most important chestnut growing areas of Europe (Radócz, 2002; Szabó, 2003) and at the end of the last century most parts of Europe were affected by the pathogen, including the Carpathian-Basin: Austria (Donaubauer, 1964), Hungary (Körtvély, 1970), Slovakia (Juhasova, 1976), Romania (Florea and Popa, 1989) and Ukraine (Radócz, 2001). At the second part of the XX-th. century blight symptoms were discovered on young oak trees in the USA (Torsello et al., 1994) and than it was also happened in several European countries (Switzerland, Italy etc.). In 1998 blight symptoms were first detected on

some young *Quercus petrea* trees in Hungary at Zengővárkony (Radócz and Holb, 2002). Then chestnut blight symptoms were reported on oaks in Romania, near Baia-Mare (Tarcali and Radócz, 2006) (*Figure 1*).

## MATERIALS AND METHODS

In 2001, field investigations were started in Ukraine. Chestnut blight symptoms were detected at the first examination on *Castanea satina* in two Sub-Carpathian populations. Then our field works were repeated year by year on the test sites in Ukraina. Last investigation were done on 07. 27. 2009. The goals of our studies were the followings:

- visual investigations of damages caused by *C. parasitica* on chestnut and on oak trees in several Ukrainian test sites (near Uzghorod and Munkachevo towns) (*Figure 1*),
- collecting of bark samples from infected or „suspected looking" plant tissues on European chestnut and on oak species for laboratory investigations,
- laboratory analysis of the collected samples,
- testing the vegetative compatibility of the isolates in laboratory.

Infection ratio (I%) and infection index (Ii) were measured according to the classification system (*Table 1*) in 10 chestnut populations near Uzghorod and Munkachevo. Bark samples were collected from the infected or suspect trees with a disinfected sharp scalpel during the field examinations for laboratory identifications and further examinations. PDA (potato-dextrose-agar) media were used for examinations in the laboratory. Surface sterilized bark samples were cultivated on PDA media and the isolates were incubated in a climated chamber for 7 days. Then vegetative compatibility tests were done. In the first step isolates were paired to study their compatibility. Than pure cultures of the isolates were paired with EU-tester strains to classify their Vegetative Compatibility Groups (VCG-s). Isoletes which formed a visible barrage zone at the edge of the growing mycelia were classified into different VCG-s.

*Table 1.*

Classification system (Ii = 1 - 5) degrees on chestnut (according to Radócz, 1998)

| Infection degree | Damage of leaves (%) | Damage of bark tissue (%) |
|---|---|---|
| Healthy tree | 0 % | 0 % |
| I. | < 10 % | Max. 10 % |
| II. | 11-25 % | Max. 25 % |
| III. | 26-50 % | Max. 50 % |
| IV. | 51-99 % | Max. 99 % |
| V. | 100 % | Dead tree<br>or dead tree with spear growing |

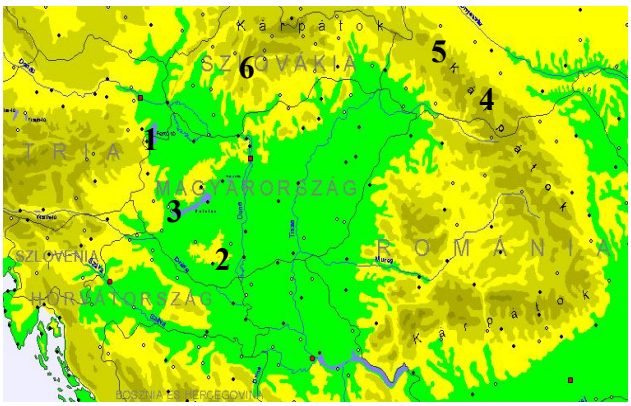


Fig. 1: Map of the Carpathian–basin and with test site

*Remarks:*

1 - Kőszeg,
2.-South-Hungarian test sites,
3 - Zengővárkony,
4 - Romanian test sites
5 - Ukrainien test sites
6 - Slovakian test site

## RESULTS AND DISCUSSION

In 2001, started our field examinations in Ukraine. Symptoms of were found on two examined chestnut stands. In Ukraine, it was the first report of the appearance of this pathogen (Radócz, 2001.). The symptoms of *C. parasitica* were detected on chestnut trees at Seredne and in Bobovisce. The infection ratio (I%) were not so high (I% - 18 in Seredne, I% - 8-12 in Bobovisce) at the first field investigation. The infection index (Ii) showed an initial stage of the blight infection (Ii – 1,00-1,17 on the scale between 1-5). On chestnut stands which were examined in Gajdos, in Gluboka and at Uzghorod, no infection of *Cryphonectria parasitica* were detected. First field examination results are detailed in *Table 1*.

In 2004. two new Ukrainien chestnut test sites were involved into our investigations (Rostovjatitsja and Perestiv). The chestnut population at Rostovjatitsja were infected at the ratio 20% and the index of the infection were more serious there (Ii – 2,55). Chestnut trees in the other new examined population (at Perestiv) were free of blight disease in 2004.

Last field examination were done on 27. 07. 2009. Three chestnut growing sites were infected by *Cryphonectria parasitica* (those populations what were infected at the early field investigations). The infection ratios were the highest (I% -35-98). Very serious infection were detected on the Bobovisce IV. test site where 98 chestnut trees were infected from 100 trees (I% -98). The infection indexes of the examined sites were also higher (Ii -2,22-Seredne – 3,60-Bobovisce IV). Some chestnut populations (Bobovisce IV, Bobovisce III) were seriously damaged of the fungus (*Figure 2-3*), and several chestnut trees were killed by *Cryphonectria parasitica* fungus (Ii – 5) (*Table 2*).

Table 2.

Results of field examinations in Ukraine

| Test sites | Time of field examinations | Examined trees | Infection degrees | | | | | | Ii | I % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Healthy tree | I. | II. | III. | IV. | V. | | |
| UNG | I. 2001.04.20. | 36 | 36 | - | - | - | - | - | - | 0 |
| UNG | II. 2002.05.08. | 35 | 35 | - | - | - | - | - | - | 0 |
| UNG | III. 2003.10.29. | 30 | 36 | - | - | - | - | - | - | 0 |
| UNG | IV. 2004.11.02. | 35 | 36 | - | - | - | - | - | - | 0 |
| UNG | V. 2006.03.14. | 35 | 35 | - | - | - | - | - | - | 0 |
| UNG | VI. 2006.10.23. | 35 | 35 | - | - | - | - | - | - | 0 |
| UNG | VII. 2009.07.27. | 35 | 35 | - | - | - | - | - | - | 0 |
| SER | I. 2001.04.20. | 100 | 82 | 15 | 3 | - | - | - | 1,17 | 18 |
| SER | II. 2002.05.08. | 100 | 94 | 2 | 3 | 1 | - | - | 1,83 | 6 |
| SER | III. 2003.10.29. | 100 | 88 | 6 | 5 | 1 | - | - | 1,58 | 12 |
| SER | IV. 2004.11.02. | 100 | 85 | 8 | 5 | 2 | - | - | 1,60 | 15 |
| SER | V. 2006.03.14. | 100 | 79 | 7 | 8 | 3 | 2 | 1 | 2,14 | 21 |
| SER | VI. 2006.10.17. | 100 | 76 | 7 | 10 | 2 | 2 | 3 | 2,33 | 24 |
| SER | VII. 2009.07.27. | 100 | 55 | 12 | 23 | 2 | 4 | 4 | 2,22 | 45 |
| GAJ | I. 2001.04.21. | 100 | 100 | - | - | - | - | - | - | 0 |
| GAJ | II. 2002.05.09. | 100 | 100 | - | - | - | - | - | - | 0 |
| GAJ | III. 2003.10.31. | 100 | 100 | - | - | - | - | - | - | 0 |
| GAJ | IV. 2004.11.02. | 100 | 100 | - | - | - | - | - | - | 0 |
| GAJ | V. 2006.03.14. | 100 | 100 | - | - | - | - | - | - | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| GAJ | VI. 2009.07.27. | 100 | 100 | - | - | - | - | - | - | 0 |
| BOB I. | I. 2001.04.21. | 100 | 88 | 10 | 2 | - | - | - | 1,17 | 12 |
| BOB I. | II. 2002.05.08. | 100 | 87 | 8 | 5 | - | - | - | 1,38 | 13 |
| BOB I. | III. 2003.10.30. | 100 | 88 | 7 | 5 | - | - | - | 1,42 | 12 |
| BOB I. | IV. 2004.11.03. | 100 | 86 | 7 | 6 | 1 | - | - | 1,57 | 14 |
| BOB I. | V. 2006.03.13. | 100 | 84 | 6 | 8 | 2 | - | - | 1,75 | 16 |
| BOB I. | VI. 2006.10.17. | 100 | 82 | 8 | 7 | 3 | - | - | 1,72 | 18 |
| BOB I. | VII. 2009.07.27. | 100 | 65 | 10 | 4 | 11 | 7 | 3 | 2,69 | 35 |
| BOB II. | I. 2001.04.21. | 100 | 92 | 8 | - | - | - | - | 1,00 | 8 |
| BOB II. | II. 2002.05.08. | 100 | 90 | 7 | 3 | - | - | - | 1,30 | 10 |
| BOB II. | III. 2003.10.30. | 100 | 89 | 7 | 4 | - | - | - | 1,36 | 11 |
| BOB II. | IV. 2004.11.03. | 100 | 90 | 4 | 4 | 2 | - | - | 1,80 | 10 |
| BOB II. | V. 2006.03.13. | 100 | 89 | 5 | 3 | 2 | - | 1 | 2,00 | 11 |
| BOB II. | VI. 2006.10.17. | 100 | 84 | 7 | 6 | 2 | - | 1 | 1,88 | 16 |
| BOB II. | VII. 2009.07.27. | 100 | 55 | 3 | 19 | 20 | 8 | 5 | 3,40 | 45 |
| BOB III. | II. 2002.05.08. | 50 | 48 | 2 | | | | | 1,00 | 4 |
| BOB III. | IV. 2004.11.03. | 50 | 46 | 4 | - | - | - | - | 1,00 | 8 |
| BOB III. | V. 2006.03.13. | 50 | 44 | 5 | 1 | - | - | - | 1,17 | 12 |
| BOB III. | VI. 2006.10.17. | 50 | 44 | 4 | 2 | - | - | - | 1,33 | 12 |
| BOB III. | VII. 2009.07.27. | 50 | 10 | 3 | 7 | 8 | 13 | 9 | 3,45 | 80 |
| BOB IV. | I. 2009.07.27. | 100 | 2 | 6 | 11 | 29 | 22 | 30 | 3,60 | 98 |
| GLU | I. 2001.04.21. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | II. 2002.05.08. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | III. 2003.10.29. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | IV. 2004.11.02. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | V. 2006.03.13. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | VI. 2006.10.23. | 100 | 100 | - | - | - | - | - | - | 0 |
| GLU | VII. 2009.07.27. | 100 | 100 | - | - | - | - | - | - | 0 |
| ROS | IV. 2004.11.03. | 100 | 80 | 6 | 5 | 4 | 2 | 3 | 2,55 | 20 |
| ROS | V. 2006.03.13. | 100 | 73 | 9 | 5 | 5 | 2 | 6 | 2,66 | 27 |
| ROS | VI. 2006.10.17. | 100 | 71 | 10 | 6 | 5 | 1 | 7 | 2,62 | 29 |
| ROS | VII. 2009.07.27. | 100 | 66 | 6 | 11 | 6 | 3 | 8 | 2,88 | 34 |
| PER | IV. 2004.11.03. | 25 | 25 | - | - | - | - | - | - | 0 |
| PER | V. 2006.03.13. | 25 | 25 | - | - | - | - | - | - | 0 |
| PER | VI. 2006.10.23. | 25 | 25 | - | - | - | - | - | - | 0 |
| PER | VII. 2009.07.27. | 25 | 25 | - | - | - | - | - | - | 0 |

Laboratory examinations were done on the collected bark samples. Pure cultures of *C. parasitica* were cultivated. Results showed that every Ukrainian isolates were virulent. Hypovirulent isolate was not identified. Results of the vegetative compatibility tests showed that two different fungal strains are on the examined areas in Ukraine. EU-12 strain of the pathogen existed in Seredne and only EU-13 fungal strain was found in Bobovisce and in Rostovjatitsja.

Since 2004. oak trees mixed with chestnuts on the test sites were also examined. There were found some suspected oak trees in the mixed chestnut-oak populations, but laboratory examinations did not confirm chestnut blight infection on them. Therefore infected oak trees by *Cryphonectria parasitica* were not found up today in the Sub-Carpathian region of Ukraine.

Fig. 2: Dead chestnut trees in Bobovisce III. test site

Fig. 3: Cankers on the bark of a young chestnut tree

## CONCLUSIONS

*Cryphonectria parasitica* infection on European chestnut (*Castanea sativa*) is increasing year by year on the Sub-Carpathian region of Ukraine. The fungus causes big destruction on European chestnut (*Castanea sativa*) there. Although infection by *C. parasitica* on oak trees were not found up today in Ukraine, this pathogen is also a new serious potential danger for local oaks there.

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