

New Results of the Research on the Alder *Phytophthora* Disease in Hungarian Alder Stands

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Abstract – Department of Forest Protection of the Hungarian Forest Research Institute started a long term monitoring project in 2002 in order to study the Alder *Phytophthora* disease, particularly to determine the importance of the disease, the extent of the damage and the severity of the infection at different regions of the country. According to the results of four years investigations, *Phytophthora* and its typical symptoms are present all over Hungary. The rate of the infected trees, the intensity and spreading of *Phytophthora* infection, together with the rate of mortality shows, that this disease currently do not poses a direct danger to the existence of alder stands. *Phytophthora* symptoms were found in 75% of the stands but in 50.9% of the plots with *Phytophthora* present the infection rate is lower than 1%.

***Phytophthora alni* / Alder decline / *Phytophthora* disease of Alder**

Kivonat – Az éger fitoftórási betegség kutatásának új eredményei a magyarországi éger állományokban. 2002-ben az ERTI erdővédelmi osztálya egy többéves kutatási programot indított a magyarországi égerpusztulással kapcsolatban, melynek célja a fitoftórási megbetegedések országos elterjedésének felmérése, a károsodott területek nagyságának megállapítása, és a fellépő fertőzések mértékének meghatározása. Négy év kutatási eredményei azt mutatják, hogy a jellegzetes fitoftórási tünetek mindenütt jelen vannak a magyarországi égeresekben. A fertőzött fák aránya, a fitoftórási megbetegedések intenzitása és terjedése, a valamint a mortalitás mértéke azt mutatja, hogy ez a betegség nem veszélyeztet közvetlenül az állományok jövőjét. *Phytophthora* okozta tünetek az állományok 75%-ban fordultak elő, de csak a vizsgált mintaterületek 50,9%-ban volt magasabb a fertőzés mértéke 1%-nál.

***Phytophthora alni* / égerpusztulás / az éger fitoftórási betegség**

1 INTRODUCTION

Common alder (*Alnus glutinosa*) covers 2.9% (47,000 hectares) of the forested area of Hungary. (ÁESZ 2002) The majority of alder forests can be found in Transdanubia (West of the Danube) and can be classified as "lowland fen type". Mountain riparian alder forests are less important from economical point of view (Danszky 1973; Bartha - Mátyás 1995) (Figure 1).

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The alder decline caused by *Phytophthora* - which was already observed in several European countries - was first recorded in Hanság (NW Hungary), close to the Austrian border in 1999. (Brasier et al. 1995; Gibbs 1995; Erwin – Ribeiro 1996; Gibbs et al. 1999; Cech 1997, 1998; Varga 2000; Nagy et al 2000; Koltay 2001)

Department of Forest Protection of the Hungarian Forest Research Institute started a long term monitoring project in 2002 in order to study the decline, particularly to determine the importance of the disease, the extent of the damage and the severity of the infection at different regions of the country.

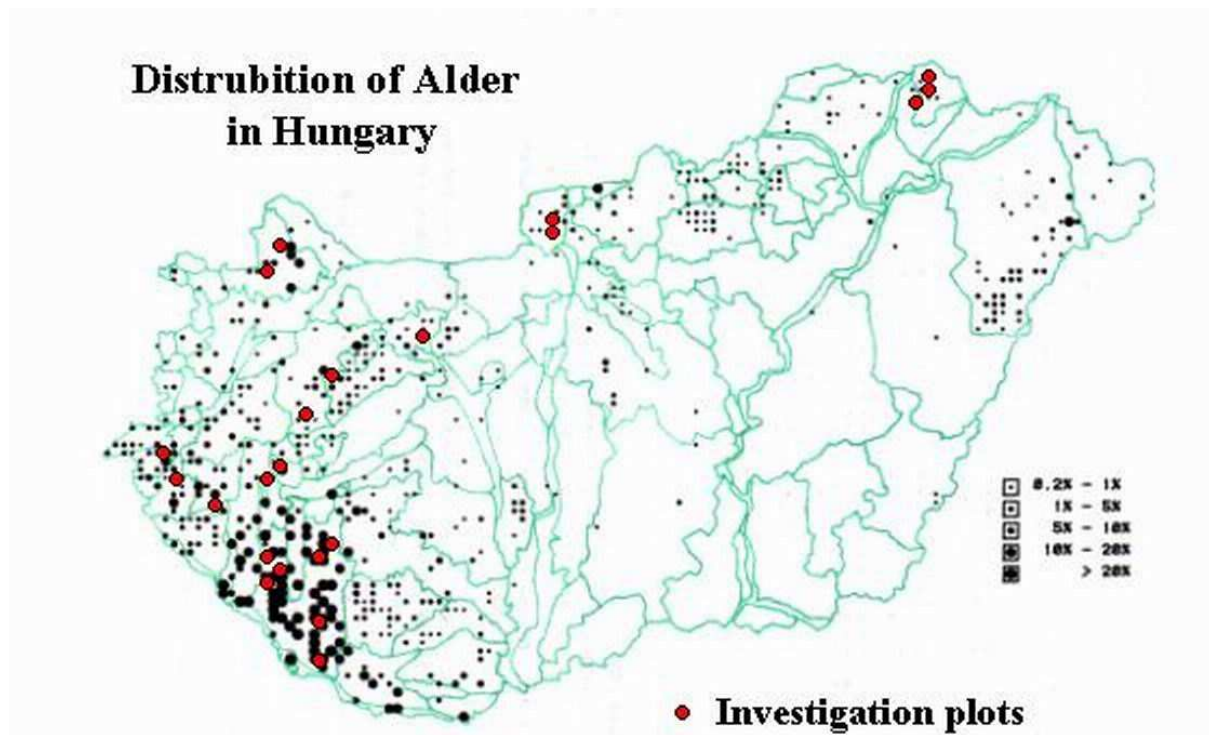


Figure 1.

2 MATERIAL AND METHODS

During 2002 and 2003 228 forest sub-compartments were investigated all over Hungary. In the investigated stands we counted the infected trees on randomly selected plots (0.25-0.50 ha each). The main symptom considered was the presence/absence of tarry spots on the stem and the root collar.

In addition to the country-wide survey, 22 long-term experimental plots were established in 2002 in different alder stands in order to carry out a more detailed study on the process and characteristics of the disease. (Figure 1)

Stands with more than 3% of infected trees and belonging to different age classes and origin (seed/coppice) were selected as experimental plots. All plots contain 50 sample trees except two containing 100. The plots were examined once in 2002, and twice in 2003-2005, late spring and late autumn (Koltay et al. 2002).

3 RESULTS

Importance of the disease, the extent of the damage and severity of infection are different regions of the country. *Phytophthora* and its typical symptoms were found all over Hungary, both in riparian and fen type alder forests. (Figure 2)

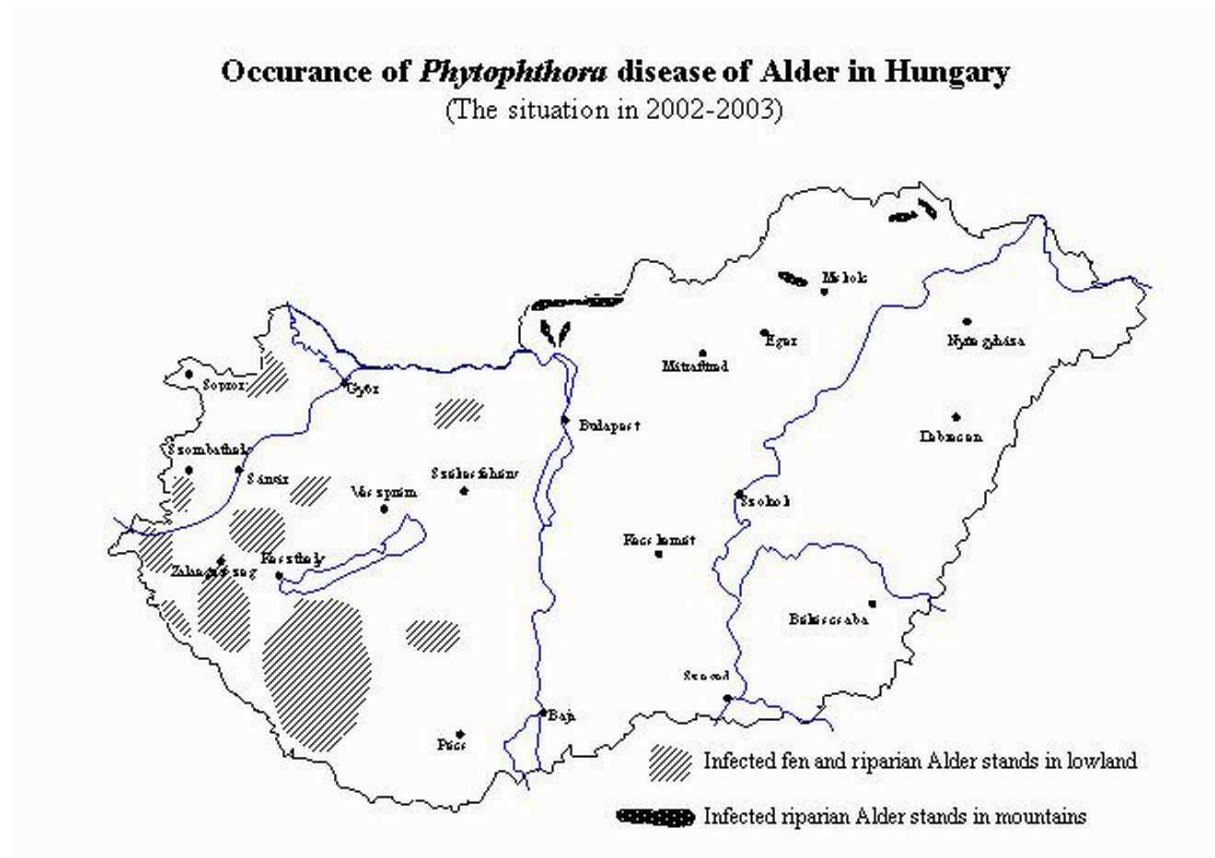


Figure 2.

Alder decline caused by *Phytophthora* can be observed in all age classes, independently of the height class of the trees. The measure of the infection and its distribution are very heterogeneous in Hungary. We found both heavily infected and healthy alder stands in each region. According to the data gained from the 228 plots investigated, symptoms of *Phytophthora* were found in 75% of the stands. (Table 1)

Table 1. Rates of *Phytophthora* infection on sample plots

Rate of <i>Phytophthora</i> Infection (%)	Investigated Alder Forests (2002-2003)	
	number	%
0	57	25,0
> 1	87	38,2
1 – 10	44	19,3
11 – 20	17	7,5
21 – 30	12	5,3
31 – 40	5	2,2
41 – 50	0	0
50 <	6	2,6
Sum	228	100,0

In 50.9% of the plots with *Phytophthora* present the infection rate is lower than 1%. In 25.7% of the plots the infection rate is between 1 and 10%, and in 23.4% of the plots the infection rate is higher than 10%. The heaviest infection - where tarry spots were found on 78% of the sample trees - was recorded in Hévíz (near the lake Balaton).

3.1 Characteristics of *Phytophthora* infection

The *Phytophthora* infection is indicated by the appearance of tarry spots on the bark. New tarry spots usually appear from autumn to spring. Most of the spots appear on the root swelling and lower part of the trunk. Sapwood always dies under the tarry spots.

Presence of tarry spots on trunk does not cause immediate crown decline. The crown usually looks healthy for 1 or 2 years after the tarry spots appeared. The rate of the crown decline depends on the progress rate of the sapwood necrosis.

After a longer or shorter time following *Phytophthora* infection, the crown becomes sparse and the leaves become abnormally small and yellow. More and more twigs and branches fall down and finally the tree dies.

3.2 Characteristics and progress of the disease

371 (30.9%) of the 1,200 sample trees at 22 experimental plots were infected by *Phytophthora* between 2002 and 2005. 75 (6.2%) trees were killed by *Phytophthora* infection during the same period.

9.3 % of the 75 dead trees died quickly (within two years), 18.6% died after three years and 72.1% died slowly, after four or more years following the infection. This means that trees usually die only longer time after the infection.

Health status of 5.3% of the infected did not change during the four years of investigation years and 2.1% of infected trees became healthy. These trees could fight the infection efficiently.

Incidence of *Phytophthora* infection is more frequent on intermediate and suppressed trees but there is no significant relation between infection frequency and the age of tree stands. (Table 2)

Table 2. *Phytophthora* infection frequency in different height class

	Height class							
	Prominent (1)		Dominant (2)		intermediate (3)		Supressed (4)	
	db	%	db	%	db	%	db	%
Infected trees with tarry spots	41	25,6	226	28,6	73	39,9	30	45,5
Total trees	160	100	791	100	183	100	66	100

4 CONCLUSIONS

According to the results of four years investigations, *Phytophthora* and its typical symptoms are present all over Hungary. The rate of the infected trees, the intensity and spreading of *Phytophthora* infection, together with the rate of mortality shows, that this disease currently do not poses a direct danger to the existence of alder stands.

It seems, that by the start of the monitoring project in 2002 (or more likely even earlier) the epidemic already reached its peak. Since then both the number of new infections and diseased trees are decreasing slowly. (Table 3)

Table 3. Rates of new necrosis and *Phytophthora* infection on sample plots

	New mortality %	New <i>Phytophthora</i> infection %
2002	-	8,5
2003	3,3	6,2
2004	2,3	6,5
2005	1,3	5,3

For the forest-management – except for some extreme highly infested forest stands – the *Phytophthora* caused no remarkable economical damage, although the possibility of this is permanently present through rise of a new and more intense epidemic.

Besides, we found, that the rate of sudden decline is relatively low. In most cases the decline-process lasts more than four years. According to our monitoring, the trees sometimes are able to defeat the disease with their natural defensive mechanisms.

Acknowledgement: The research was supported by OTKA T 038309 (National Scientific Research Fund)

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