

# Occurrence and impact of *Phytophthora* species in forest trees in Hungary

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Occurrence of *Phytophthora* species and their phytopathological role have been investigated in forest stands in Hungary since 1999. Trees with specific stem lesions and unspecific top drying symptoms were surveyed in forest stands of different tree species in order to find the causal agents and especially to clarify the role of the *Phytophthora* species in decline.

## Symptoms

*Phytophthora* species were found in *Alnus glutinosa* with bleeding stem lesions and crown drying symptoms, and in *Juglans nigra*, *Quercus petraea* and *Q. cerris* with crown drying symptoms (Fig. 1-3).



Fig. 1. Bleeding lesions in alder



Fig. 2-3. Crown drying in oak and black walnut



## Isolation

The isolation was carried out from soil samples taken from around the diseased trees, by baiting with *Prunus laurocerasus* leaves on selective medium PARPNH (Fig. 4-6).



Fig. 4-6. Method of isolation

## Identification

### Morphological identification

The morphological identification was based on the culture patterns and growing rate of the colonies and on the morphology of the microscopical structures (Fig. 7-11).



Fig. 7. *P. alni*: colony, sexual organs and sporangia



Fig. 8. *P. citricola*: colony, sexual organs and sporangia



Fig. 9. *P. cactorum*: colony, sexual organs and sporangium



Fig. 10. *P. megasperma*: colony, sexual organs, sporangia

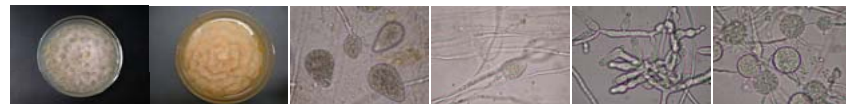


Fig. 11. *P. gonapodyides/inundata*/sp.1. complex: colonies, sporangia, internal proliferations, hyphal swellings

## Molecular identification

The molecular identification was performed by sequencing the ITS regions of the rDNA and comparing with the known *Phytophthora* sequences accessible in GenBank database (Fig. 12.).

The morphological and molecular identification resulted in 8 *Phytophthora* species in *Alnus* (*P. alni*, *P. citricola*, *P. gonapodyides*, *P. inundata*, *P. megasperma*, *P. sp.1*, *P. sp. 2.*, *P. sp. 3.*), 4 in *Juglans* (*P. cactorum*, *P. citricola*, *P. hedraiaandra*, *P. sp.1*) and 2 in *Quercus* (*P. citricola*, *P. gonapodyides*). The species belong to the 4 major clade of the phylogenetic tree resulted by the analysis using Mega2 statistical program (Fig. 12.).

	<i>Alnus glutinosa</i>	<i>Juglans nigra</i>	<i>Quercus petraea</i>	<i>Quercus cerris</i>
<i>Phytophthora alni</i>	X			
<i>P. cactorum</i>		X		
<i>P. citricola</i>	X	X	X	X
<i>P. gonapodyides</i>	X		X	
<i>P. hedraiaandra</i>		X		
<i>P. inundata</i>	X			
<i>P. megasperma</i>	X			
<i>Phytophthora</i> sp. 1	X	X		
<i>Phytophthora</i> sp. 2	X			
<i>Phytophthora</i> sp. 3	X			
<b>Total</b>	<b>8</b>	<b>4</b>	<b>2</b>	<b>1</b>

Table 1. Result of the species identification

## Pathogenicity

The pathogenicity of the isolates was tested by wound inoculation in the stem of seedlings and by root infection. The inoculations caused well-delimited bark necrosis in the stem of seedlings, the largest by *P. alni* in alder (Fig. 13.) and *P. citricola* in black walnut (Fig. 14.), but generally not exceeding 3-4 cm length (Fig. 15.). Root infections caused lesion and reduction of fine roots, most pronounced by *P. citricola* in black walnut.



Fig. 13. *P. alni* in *Alnus*



Fig. 14. *P. citricola* in *Juglans*

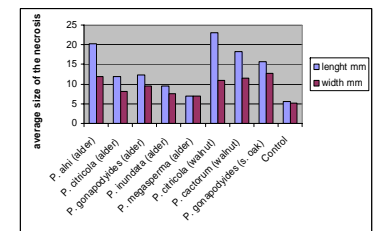


Fig. 15. Result of the stem inoculation of seedlings

## Conclusion

The impact of *Phytophthora* species on the healthy condition of the forest trees in Hungary is most important in *Alnus glutinosa* and *Juglans nigra* stands situated in wet sites and flood areas respectively. A community of *Phytophthora* species occurs in the rhizosphere of these trees causing root and collar rot symptoms in alder and fine root reduction manifesting by crown drying in walnut.

**Acknowledgement:** The research was supported by the Hungarian Research Found (OTKA) grants T 037352 and T 049077.