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Ink disease of European chestnut and distribution of associated *Phytophthora* species in Greece

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Introduction

Ink disease and chestnut blight of European chestnut (*Castanea sativa*) represent the two major threats for chestnut orchards and coppice forests in Greece. However, since the application of biological control of chestnut blight by introducing hypovirulence of *Cryphonectria parasitica* on a nationwide scale in Greece has been successful in limiting chestnut blight, ink disease is an increasing threat as it causes considerable loss.

Aim

Investigation of the occurrence of ink disease on chestnut and creation of an updated distribution map of *Phytophthora* spp. in Greece.

Materials and Methods

Soil and tissue samples were collected from coppice forests and chestnut orchards. Isolations from soil were carried out by baiting with rhododendron (*Rhododendron catawbiense*) leaves and from tissue by direct plating on selective medium (PARBHy agar). The obtained *Phytophthora* isolates were identified on the basis of their morphological and molecular traits.

Results

- The presence of ink disease was confirmed all over the country.
- The *Phytophthora* species involved in the disease were recorded.
- A total of seven *Phytophthora* species have been detected.
- *P. cambivora*, *P. cinnamomi* and *P. cryptogea* were recovered both from soil and tissue.
- *P. plurivora*, *P. cactorum*, *P. gonapodyides* and *P. citrophthora* were isolated only from soil.
- *P. cambivora* is the prevailing species in chestnut orchards and natural coppice stands.
- The recent record of the more aggressive *P. cinnamomi* is now considered a potential major threat to *C. sativa* in Greece.
- Trees in both orchards and coppices are affected.
- In coppice forests the disease is restricted in wet locations.
- In orchards the disease appears to be correlated with traditional irrigation methods such as flooding.

Figure 1. Distribution of Ink Disease of chestnut in Greece.

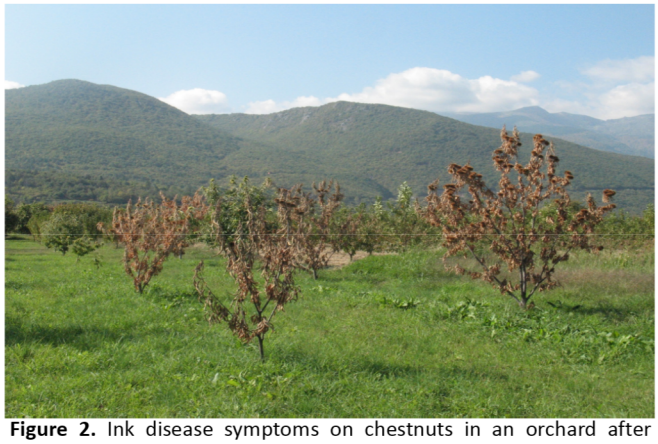

Figure 2. Ink disease symptoms on chestnuts in an orchard after flooding due to a leakage in the irrigation system.

Table1. *Phytophthora* species isolated from coppice forests and chestnut orchards in Greece.

	Tissue	Soil	Habitat
P. cambivora	✓	✓	Orchard/ Coppice
P. cryptogea	✓	✓	Orchard
P. cinnamomi	✓	✓	Orchard
P. plurivora	-	✓	Orchard/ Coppice
P. cactorum	-	✓	Orchard
P. gonapodyides	-	✓	Orchard
P. citrophthora	-	✓	Orchard/ Coppice

Figure 3. Ink disease symptoms on chestnut. Dead leaves and burrs remained attached to the tree (left) and dark flame-shaped necrosis at the base of a chestnut tree (right).