Ophiostoma novo-ulmi

Taxon	Family / Order / Class / Phylum / Kingdom
Ophiostoma novo-ulmi (Brasier 1991)	Ophiostomataceae / Ophiostomatales / Ascomycetes / Ascomycota / Fungi

COMMON NAMES (English only)
Dutch elm disease.

SYNONYMS
None.

SHORT DESCRIPTION
Two destructive pandemics of Dutch Elm Disease occurred in the 20th century, caused by two closely related micro-fungi. *Ophiostoma novo-ulmi*, initially termed the aggressive subgroup of *O. ulmi sensu lato*, was responsible for the more recent second pandemic and has progressively replaced *O. ulmi sensu stricto*, less aggressive and competitive, which caused the first one. *O. novo-ulmi* includes two sub-species, *O. novo-ulmi* subsp. *americana* and *O. novo-ulmi* subsp. *novo-ulmi*. Dutch Elm Disease is a wilt disease, first discovered and studied in the Netherlands by seven pioneering female scientists.

Group of dying and dead elms affected by Dutch Elm Disease caused by *Ophiostoma ulmi* and *O. novo-ulmi*

Photo: Forest Research © Forestry Commission

BIOLOGY/ECOLOGY

Dispersal mechanisms
O. novo-ulmi is disseminated by specialized bark beetles (mainly *Scolytus scolytus* and *S. multistriatus* in Europe). The fungus can also spread via root grafts between trees.

Reproduction
O. novo-ulmi has three asexual stages: a *Sporothrix*-like stage, a *Graphium* stage (with conidia) and a yeast-like stage. Sexual reproduction involves the encounter of mycelia of two compatibility types (heterothallic species) and results in the production of ascospores.

Known predators/herbivores
O. novo-ulmi is host to deleterious viruses, known as d-factors, which can spread abundantly in clones of the fungus but no longer when the fungus population diversifies. The fungus *Phomopsis* is a competitor of the elm bark beetles, by quickly invading the bark of newly dying elms and acts as a strong natural biological control of the beetle populations in some areas.

Resistant stages (seeds, spores etc.)
Ascospores are produced in a black fruiting body (perithecium) which is a resistant stage.

HABITAT

Native (EUNIS code)
G: Woodland, forest and other wooded land.

Habitat occupied in invaded range (EUNIS code)
G: Woodland, forest and other wooded land , I2: Cultivated areas of gardens and parks. Host trees include all the Euro-American native elms, much more susceptible to *O. novo-ulmi* than Asian elms.

Habitat requirements
Disease expression is strongly correlated with temperature and number of sunshine hours, levels of defoliation being greatest for mean air temperature above 17°C and 5-7 hours sunshine. Higher temperatures also increase the size and number of annual bark beetle generations.

DISTRIBUTION

Native Range

Both *O. ulmi* and *O. novo-ulmi* are believed to come from Asia

Known Introduced Range

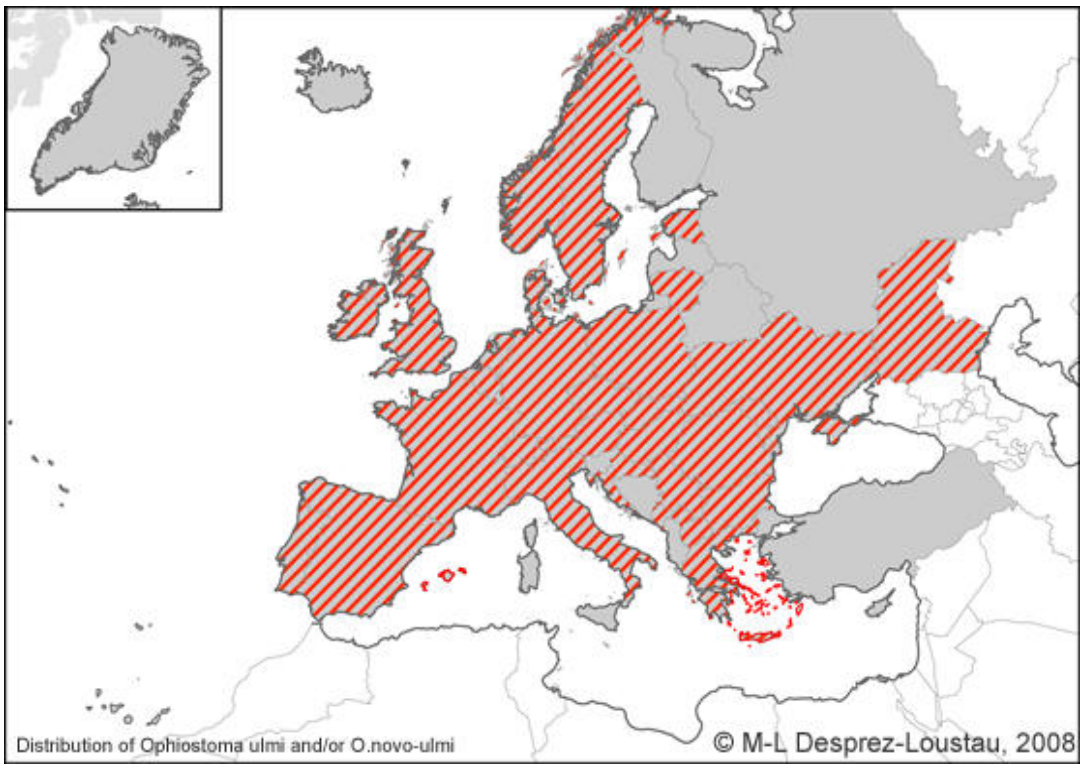
The two pandemics of Dutch Elm Disease both affected the North American and Eurasian continents.

Trend

Most European countries are in a post epidemic situation. However, the disease is still spreading in northern Europe, especially Scotland. Climate warming might favour its northwards expansion.

MAP (European distribution)

Distribution of *Ophiostoma ulmi* and/or *O.novo-ulmi*.



Legend

	Known in country		Known in CGRS square		Known on coast

INTRODUCTION PATHWAY

O. novo-ulmi first appeared in Europe in the 1940's in the Moldova-Ukraine region (subsp. *novo-ulmi*). The subsp *americana* appeared in the southern Great Lakes area in North America at about the same time and was later introduced to Great Britain ca. 1960, probably with a shipment of elm logs. Subsequent spread of both subspecies throughout Europe was mainly caused by natural migrations, involving bark beetle vectors.

IMPACT

Ecosystem Impact

Trees infected by beetles first show wilting, curling and yellowing of leaves on one or several branches. Once the fungus is established within a tree, it spreads rapidly via the water-conducting vessels. Gums and tyloses are produced by the tree in response to infection, causing the occlusion of vessels and eventually wilting and death of the tree. Few mature native elm trees (*U. procera*, *U. carpinifolia*, *U. minor*, *U. glabra*) are left in much of Europe. In the UK alone, it has been estimated that more than 25 million trees have died. The elms mostly survive as shrubs, especially in hedgerows, as the roots are not killed and produce root sprouts ("suckers"). These suckers rarely reach more than 5 m tall before succumbing to a new attack of the fungus.

Health and Social Impact

Elms have a high landscape and ornamental value.

Economic Impact

Unknown.

MANAGEMENT

Prevention

Considerable effort has been put into breeding disease-resistant elms. Thousands of cuttings from surviving native elms have been screened. A few of them showed some resistance, giving hope for the reestablishment of native elms in countryside and forest. However, until now, none reached the level of resistance of resistant cultivars (such as Sapporo Autumn Gold® and Lutece ®) obtained by hybridisation with Asian elms for ornamental plantings.

Mechanical

Community-wide sanitation programs, involving the removal of infected trees, are the key to slowing disease spread. They have been successfully applied in New Zealand for example.

Physical

Unknown.

Chemical

In urban situations, insecticide spraying of high value trees can be effective in preventing bark beetles from attacking trees.

Biological

Unknown.

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