Main biotic damage agents of cypress:

Necrosis of the bark and cankers
- *Seiridium cardinale* mitosporic fungus;
- *Diplodia cupressi* mitosporic fungus;
- *Pestalotiopsis funerea* mitosporic fungus

Blight of twigs and small branches
- *Phomopsis occulta* mitosporic fungus;
- *Phloeoisinus aubei; P. thujae; P. armatus* Scolitid beetles;
- *Cinara cupressi* Lacnidae aphid.
Bark canker of cypress caused by *Seiridium cardinale* (Cypress Canker Disease)

It is the most harmful disease of cypress;

It has a pandemic spread and has been reported in the warm-temperate regions of all continents;

Introduction of the pathogen in new regions gave rise to epidemics; particularly severe were those developed in the Mediterranean area;

The disease causes the progressive dieback (death) of twigs, branches, trunk;

It can kill a tree within few years;

Most of the diseased trees die.

Brief notes on the biology of *S. cardinale*

The fungus is a wound pathogen that enters the bark tissues through small lesions caused by frost, hail, insects, excessive growth. The fungus then colonizes the living bark causing necrosis (using a set of enzymes to destroy the cell walls and also toxins). The necrotic area develops within few weeks around the point of infection.
By removing the outer bark the necrotic area is exposed. It is generally fusiform and brown in colour (sometimes with purple shades). When the necrosis arrives to girdle a branch (or stem) the wilting of the upper portion will occur and symptoms are visible at a distance.

Typical symptoms on diseased cypress crowns due to cankers that have girdled stems and branches causing the death of the upper portion (cankers are located at the base of the diebacks).
More subjected to infections are young trees or the younger parts of the trees (twigs and small branches) located in the outer portion of the crowns, because they are more exposed to the inoculum in the environment and also have a subtle periderm.

Young plants growing in the nursery and vigorous adult trees can produce large amount of resin as a consequence of developing cankers. Resin oozed from cankered bark often flows downwards along affected stem or branches. This is a typical sign of the disease.
Cankers develop progressively on the crown, giving rise to other (secondary) infections in the lower parts. The whole infections cause the death of the tree.

Advanced symptoms on heavily affected trees with cankers developed in various portions of the crowns.
Reproduction and spread of the pathogen

During spring and autumn when RU and temperature values reach the optimum for the growth and reproduction of the pathogen (25°C and 100% RU), fruitbodies of the fungus (aceruli) develop on the surface of the cankered bark. Acervuli appear as black pustules less than 1mm in size containing thousands of conidia, the spores of the fungus.

Conidia are spread in the environment by rain drops and wind, insects so producing new infections.

Symptoms

1. On twigs, branches and stems:
   • necrosis of the bark; development of cankers which may cause distortion, flattening and cracking of the axis;
   • resin emission from the cankered area.

2. On the crown:
   • wilting and reddening of the foliage of the affected twigs branches and stems, dieback these are visible at a distance.
Progressive growth of the cankers cause the death of the twigs inserted in correspondence of necrotic bark. When the axis is girdled by the canker we observe the death of the upper portion of the crown.
Experimental Field

In an experimental field the more susceptible clones are easily recognizable because artificial inoculations cause visible symptoms (death of branches or stems tops).

Extreme evolution of symptoms
Sometimes cankers affecting trunks seem to stop their development for years, but then they restart their growth producing new symptoms.
Only few trees are able to block the growth of the cankers through the production of barriers in the bark and then to heal the lesion. But most of the diseased trees will die.

Spread of the disease

<table>
<thead>
<tr>
<th>U.S.A</th>
<th>EUROPE</th>
<th>ITALY</th>
<th>Other Mediterranean Countries</th>
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<tbody>
<tr>
<td>California</td>
<td>France</td>
<td>Florence</td>
<td>Greece, Israel, Turkey</td>
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<tr>
<td>C. macrocarpa</td>
<td>C. macrocarpa</td>
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<td>C. sempervirens</td>
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<td>Other species</td>
<td>C. sempervirens</td>
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Reports in: North and South America, New Zealand, Australia, North and South Africa, Asia (Japan), Europe.

Ospiti: Cupressus, Thuja, Juniperus, xCupressocyparis leylandii, Chamaecyparis, Cryptomeria.

Incidence

In the 80s S. cardinale epidemics caused heavy damages in some Med regions with incidence of diseased trees as high as 80% in Greece and Tuscany.

Today:

Endemic in all the Mediterranean; Mean incidence in Tuscany: 22% (Meta-ARSIA); peaks exceeding 50% in the provinces of Siena and Arezzo.

Today heavy damages have been reported on Cupressocyparis leylandii a variety that has been widely planted in barriers for its rapid growth.
Il cancro del cipresso

Sviluppo in Italia a partire dagli anni '50;
Anni'70: gravi epidemie in Toscana e altre regioni mediterranee (Grecia).
Interventi fitosanitari onerosi e non estendibili a tutto il territorio.
Oggi: endemica in tutto il Mediterraneo, con situazioni gravi dove l'incidenza è superiore al 50%

- articolo su La Repubblica (10.01.2008): denunciava la difficoltà di controllo della malattia nella provincia di AR (1.2 mln di €/anno spesi negli ultimi 10 anni);
- stessa cifra spesa per la Prov di Siena;
- Viale di Bolgheri: stanziamento di 1mln di € per il progetto di cura e riqualificazione.

Other diseases and pests
Other two Seiridium species

*Seiridium cupressi* (anamorph of *Lepteutypa cupressi*)

- same symptoms of *S. cardinale*;
- more aggressive during the warmer months (summer) compared to *S. cardinale*;
- epidemics in New Zealand, Australia, Africa, but not in the Mediterranean;
- it was reported only in the island of Cos (Greece) where diseased trees were soon felled,

Often *S. cupressi* has been confused with

*Seiridium unicorne*:

- Reported on host of different families;
- less virulent than the other two *Seiridium*;
- in Europe it was reported only in Portugal but not as an epidemic.

**Diplodia cupressi**

(syn. *Diplodia* sp.; *Sphaeropsis sapinea* f.sp. *cupressi*) is responsible for cankers on trunks and branches, and was reported for the first time in 1987 in Israel.

Longitudinal fissures appear in correspondence with necrotic areas on the branches and on the trunk, accompanied by resin emission.

Crown symptoms are similar to those caused by *S. cardinale*.

The pathogen tends to attack plants that are weakened by various stress factors, frequently by water stress.

It can kill a tree within few months.

Recently in Italy, it has been observed on large-size cypress trees which had undergone a weakening as a result of being balled and transplanted into vases (Fig. 18).
Diplodia cupressi

Control:

- chemical prevention;
- trees must avoid stress conditions when grown in the nursery;
- removal of symptomatic trees.
**Phomopsis occulta**

*P. occulta* attacks various coniferous trees but is particularly active on Cupressaceae and on *C. sempervirens*.

The first symptoms are yellowing, reddening, and wilting of twigs and young branches with a diameter of less than 1 cm.

Generally infections do not continue the following year on a same canker. It only rarely gives rise to perennial fusiform cankers on trunk and branches.

The necrotic bark tissues appear fibrous, light brown in colour, dry and not resin-soaked.

Infections are favoured by the humid and cool course of spring.

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**Phomopsis occulta**

In young plantations and on seedlings in the nurseries the disease can develop in epidemic form, causing widespread death.

Control:

- in nurseries: chemical prevention and removal of diseased plants;
- on adult trees: cutting off infected twigs and branches.
Coleotteri del gen. *Phloeoinus*

Armillaria root rot

This is one of the most well-known and destructive parasites. It is a polyphagous species that causes root rot in a series of trees and shrubs, including the *Cupressus* genus.

Cypress trees stressed by the cold, dryness, and particularly by water stagnation are particularly susceptible to its attacks (especially in windbreaks, ornamental hedges and gardens).

*Ameliea* is often found in the soil (especially if formerly cultivable) as saprophyte, a coloniser of tree stumps of dead plants and rotting debris.

When trees are weakened, the rhizomorphs of the fungus penetrate the roots invading and colonising the cambium of the entire root system of cypress. This leads to the decline of the entire crown and the death of the tree. Decay of the of the collar and of the root system can place the stability of the plant at risk.
Armillaria root rot

The development of a layer of whitish sub-cortical mycelium at the base of the trunk is easily identifiable and emanates a typical odour of fungus.

Control of *A. mellea* is extremely difficult, since the fungus is polyphagous and is present on the organic residues in the soil where it can be conserved for many years, as a saprophyte.

The best control strategy consists of:
- maintaining the trees in good vegetative conditions, avoiding water stagnation,
- care must also be taken to eliminate the largest possible part of the organic residues from the soil,
- a control of the drainage of the soil, which is very often the main cause of the development of this disease, especially in parks and gardens, is definitely an important element in this strategy.

Phloeosinus barkbeetles

Type of injury

The cypress barkbeetle breeds under the bark of dead and dying trees but is more often found under the bark of felled trees or in dead branches.

The adults feed on the inner bark and also, when newly emerged, bore into small twigs, mining down the centre and leaving only a thin shell. Such attacked twigs break off.
**Phloeosinus beetles**

Their biological cycle is among dying and healthy cypresses.

1. **Overwintering**

2. Oviposition (on dying and declining trees)

3. Feeding (on healthy trees)

4. Oviposition (on dying and declining trees)

Beetles are contaminated with *Seiridium* inoculum.

**Spread of the canker (new infections)**

1st generation (July)

2nd generation (September)

**Coleotteri del gen. Phloeosinus**

Galleria di svernamento da cui ha avuto inizio il cancro.

Attacchi di Phloeosinus: i getti secchi sono penduli.
**Phloeosinus barkbeetles**

**Control:**

Removal of cypress trees:
- severely cankered;
- declining;
- dead.

Cutting off the cankered branches;

Removal of the felled trunks or removal of the bark from wood (debarking).

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**Cinara cupressi aphid**

*Cinara cupressi* is a bark aphid of the *Lachnidae* family that causes reddening and wilting on the crowns due to the sap-sucking action performed by the colonies settled on the small branches during the spring period.

**Injury is caused by:**

- sap subtraction (piercing-sucking mouthpart);
- injection of toxic substances in the tissues;
- covering effect of the “sooty moulds” that develop in abundance on the copious sugary honeydew that cover the photosynthetic organs so reducing the normal photosynthetic function.
**Cinara cupressi aphid**

In favourable years with strong attacks, the most extensively and intensely colonized trees can even die.

- pullulation are favoured by a mild course of winter and summer.
- first symptoms appear in spring: reddenings (patchy or widespread to large sectors of the crowns).
- they are caused by colonies that envelop the branches like a sleeve starting from the more internal ones.
- *C. sempervirens* often can recover; *C. glabra* is more susceptible due to its low capacity to regenerate new shoots from adventitious buds.

**Control**

- monitoring the development of the colonies at the beginning of spring;
- forced jets of water (to disperse colonies);
- treatments with pyrethroids and carbamates (per limitare lo sviluppo a dismisura delle colonie) that must be done at the first increase of aphid populations.

Treatments executed when symptoms appear are useless.
Main diagnostic differences

Spread of symptoms on the crowns

Evenness and distribution

Main diagnostic differences

Exudations

Changes on different organs

Cypress canker

Cypress aphid

Cypress canker

Cypress aphid
Main diagnostic differences

Cypress canker

Cypress aphid

Display of damages

Simultaneous attacks of both canker and aphid
Abiotic stress factors

Frost damages

Injuries to cypress due to the lowering of the temperature are often connected with the latitude, altitude, position, exposure, and type of use of the plants (hedges, windbreak barriers) and their physiological state.

Nursery grown plants are particularly sensible to cold: in fact, fertilising (N) and irrigation favour the development of parenchymal tissues that are notoriously richer in water and thus more sensible to drops in temperature.

Late (spring) frost cause micro-lesions in the young twigs and branches favouring the penetration of numerous pathogens, among which is *S. cardinale*.

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**Frost damages**

- **To shoots**

damages due to cold are manifested with an abrupt change in colour of the crown, which becomes straw-yellow to reddish, then dark red, and lastly turns brown

- **To trunk and branches**

Necrosis of the cambial tissues (more sensible when in activity)

These will give rise to the so-called cold rings, defects (due to the presence of resoin and gums) which will be noted during the various weathering and workmanship phases.

When the temperatures drop to below -12°C, the branches and trunk can suffer longitudinal cracks long and deep, forming the so-called “frost rib”.

This is a serious defect in the wood.
Water stress

- Drought

Most cypress trees, including *C. sempervirens*, tolerate well water shortage and fit into different types of soil. Furthermore, *C. sempervirens*, differently from other species, e.g. *C. lusitanica* and *C. macrocarpa*, is capable of tolerating low relative humidity during in summer.

- Water excess (stagnation)

Cypress is very sensible to water stagnation (difficult drainage, excessive watering when planted in windbreaks or in meadows).

In these conditions, plants are easily subject to the Armillaria root rot.
Cypress of San Anton Gardens - Malta