



Root and Butt Rot (*Heterobasidion irregulare*)



Background

Heterobasidion irregulare is a fungal pathogen that causes root and butt rot in coniferous and some deciduous trees, with symptoms visible all year round. Originally found across the Americas, it has spread to Italy and poses a threat to European forests.

The pathogen primarily proliferates through airborne spores released from late summer to winter, infecting freshly cut stumps and wounds, but can also spread via mycelia (vegetative fungal structures) through root-to-root contact.

The main hosts of *H. irregulare* are trees in the *Pinus* (pine) and *Juniperus* (juniper) genera. In pine, both young and adult trees are susceptible, and mortality in young trees can be rapid (within one season). In adult trees, root decay can be extensive (up to 2/3 of the root system) before symptoms appear in the crown, and trees can take up to 10 years to die.

Symptoms

- Formation of a disease centre: a roughly circular area of infected trees, spreading from declining trees to those with no visible symptoms. The centre contains old, dead trees, while successive outer zones show progressively healthier trees (Fig 1a, b).
- A patch of dead and declining trees, often leading to wind-thrown trees (Fig 2.).
- Thinning crowns with chlorotic (yellowing) foliage and needle shedding, which leads to "lion's tail" symptoms (Fig 3a, b.).
- White, paper-thin sheets of mycelium below the bark (Fig 4.).
- Fruiting bodies that develop in the soil at the base of trees or stumps. They may form as "foam" rising from underground infected roots (Fig 5a, b, c.).
- Infected roots generally show heavy resin soaking (Fig 6.).
- Root lesions and white, stringy-looking root decay (Fig 7.).
- These symptoms are similar to those of other *Heterobasidion* species and *Armillaria* species, so laboratory testing is required.



Fig 1. Disease centres a) Aerial view of a pine forest in the US, b) Side view of a pine forest in Italy.



Fig 2. Wind-thrown western hemlock with root rot.



Fig 3. Diseased crowns a) Chlorotic needles, b) "Lion's tail".



Fig 4. White, paper-thin mycelium sheets below tree bark.



Fig 5. a), b), c) Fruiting bodies of *H. irregulare*.



Fig 6. Resin soaking of root wood.



Fig 7. Stringy-white rot typical of advanced root decay.