FOREST PEST SPECIES PROFILE

January 2008

Mycosphaerella pini Rostrup (1957)

Other scientific names: *Cytosporina septospora* Dorog.; *Dothistroma pini* Hulbary; *Dothistroma pini* var. *keniense* M.H. Ivory [as *'keniensis'*]; *Dothistroma pini* var. *lineare* Thyr & C.G. Shaw; *Dothistroma septosporum* (Dorog.) M. Morelet [as *'septospora'*]; *Dothistroma septosporum* var. *keniense* (M.H. Ivory) B. Sutton; *Dothistroma septosporum* var. *lineare* (Thyr & D.E. Shaw) B. Sutton; *Dothistroma septosporum* var. *septosporum* (Dorog.) M. Morelet; *Eruptio pini* (Rostr.) M.E. Barr; *Mycosphaerella pini* (A. Funk & A.K. Parker) Arx; *Scirrhia pini* A. Funk & A.K. Parker; *Septoria septospora* (Dorog.) Arx; *Septoriella septospora* (Dorog.) Sacc.
Phylum, Order, Family: Ascomycota: Capnodiales: Mycosphaerellaceae
Common names: pine needle blight; dothistroma needle blight; needle fungus; red band needle blight

Mycosphaerella pini is a fungus that infects and kills the needles of *Pinus* spp. resulting in significant defoliation, stunted growth and eventually death of host trees. It is a major pest in both naturally regenerating and planted forests and probably the most important foliage disease of exotic pines. Susceptibility among pine species does vary. The widely planted *P. radiata* is particularly susceptible and many forests planted with this species in the Southern Hemisphere, particularly in East Africa, New Zealand and Chile, have been devastated by this needle blight. This pathogen has forced managers in some areas to abandon the planting of *P. radiata* and depend more on other tree species.

Red transverse bands on pine needles are a characteristic symptom of *Mycosphaerella pini* infection (Photos - Bugwood.org L-R: R.L. James, USDA Forest Service; USDA Forest Service Archive)

DISTRIBUTION

Mycosphaerella pini is believed to be native to the cloud forests of Central America though it now has a worldwide distribution (EPPO/CABI, 1997).

IDENTIFICATION

Ascostromata are black, multiloculate, subepidermal, erumpent, 200-600 by 95-150 µm in size and densely aggregated in red bands (EPPO/CABI, 1997; Hildebrand, 2005). Asci are cylindric or clavate, bitunicate, apex rounded, eight-spored, and 46-52 x 8-10 µm in size (Hildebrand, 2005). Ascospores are hyaline, with one septum, fusiform to cuneate, and 13-16 x 3-4 µm in size (Hildebrand, 2005).

The conidial state is known as *Dothistroma septosprum*. Conidial stromata are linear, subepidermal, erumpent, dark brown or black, 125-1500 µm long, 5-45 µm wide and up to 600 µm high (Hildebrand, 2005). Conidial locules are parallel to the longitudinal axis of stromata and lack a distinct wall (Hildebrand, 2005).

Conidiophores are numerous, hyaline or amber, dense, unbranched and are approximately the same size as the conidia which they produce at their tips (Hildebrand, 2005). Conidia are hyaline, one- to five- but usually three-septate, blunt at the ends, straight, slightly curved or bent and 16-64 x 3.5 µm in size (Hildebrand, 2005).

HOSTS

The main hosts are pines, such as *Pinus contorta*, *P. echinata*, *P. jeffreyi*, *P. monticola*, *P. muricata*, *P. pinaster*, *P. ponderosa*, *P. radiata*, *P. resinosa*, and *P. sylvestris*, although other species such as *Picea abies*, *Picea sitchensis*, *Pseudotsuga menziesii* and *Larix decidua* have been infected (EPPO/CABI, 1997).

BIOLOGY

Mycosphaerella pini produces both conidia and ascospores although the conidial state is most frequently encountered (Hildebrand, 2005). Numerous conidia are produced in the stromata (fruiting bodies) which develop below the epidermis of infected needles (Peterson, 1982). Stromata can remain viable on dry infected foliage for many months and will produce conidia when suitable moist conditions arise (Hildebrand, 2005). Conidia are dispersed short distances by rain splash and longer distances by wind-dispersed moisture droplets, mist and low clouds (EPPO/CABI, 1997; Hildebrand, 2005). Optimum temperatures for spore germination are between 18 and 24°C (Hildebrand, 2005). After germination, germ tubes grow toward the stomata through which infection occurs. The fungus grows within the needle tissue and kills cells with the toxin, dothistromin, in advance of the growing hyphae (Hildebrand, 2005). Dead needles remain attached to the host tree and produce spores for approximately one year (Hildebrand, 2005).

SYMPTOMS AND DAMAGE

Mycosphaerella pini is a fungus that infects and kills the needles of many *Pinus* spp. resulting in premature loss of needles and significant defoliation. Damage by *Mycosphaerella pini* has significant impacts on commercial forests, Christmas tree plantations and nurseries. This pathogen can spread rapidly when environmental conditions, mild climate with high rainfall or frequent fog or mist, favour infection.

Symptoms of *Mycosphaerella pini* infection on *Pinus nigra*
(Photo: A.S. Munson, USDA Forest Service, Bugwood.org)

Infected host trees typically have thin crowns with discoloured and dead needles, especially on the lower crown (Hildebrand, 2005). Early symptoms are the presence of yellow to tan spots on needles which later turn brown or reddish brown and enlarge to produce the characteristic red band around the needle (Peterson, 1982; Hildebrand, 2005). These red bands are diagnostic for this disease and are caused by the presence of dothistromin, a toxin produced by *M. pini* (Hildebrand, 2005). The ends of infected needles eventually turn

brown but the bases of the needles remain green (Peterson, 1982; Hildebrand, 2005). Small black fruiting bodies break through the needle epidermis in the centre of the red band (Hildebrand, 2005). Infected needles die and drop prematurely typically leaving branches with only terminal needles remaining (Hildebrand, 2005). Older needles are typically cast before younger needles. The development of epicormic shoots on the stem and major branches of infected host trees may also occur (EPPO/CABI, 1997). Host trees can be defoliated within weeks and successive years of infection results in stunted growth and eventual mortality.

DISPERSAL AND INTRODUCTION PATHWAYS

Mycosphaerella pini produces numerous conidia that can be dispersed short distances by rain splash; long distance dispersal is often through wind dispersed moisture droplets, mist and low cloud (EPPO/CABI, 1997; Hildebrand, 2005). Ascospores can also be wind-dispersed long distances.

Longer distance spread can occur through the movement of infected planting stock, seed mixed with small infected needle pieces and logs which have infected needles lodged in the bark crevices (EPPO/CABI, 1997; Hildebrand, 2005). Once the pathogen has been transported to new areas, it is capable of producing spores and thereby spreading to nearby suitable hosts as long as there is sufficient moisture for spore germination and infection (Hildebrand, 2005).

CONTROL MEASURES

Mycosphaerella pini has been successfully controlled through the use of copper fungicides although over large areas their use is not always economically feasible (EPPO/CABI, 1997; Hildebrand, 2005). In nurseries and Christmas tree plantings however, the application of fungicides can be effective and economical (Hildebrand, 2005). Pruning and the planting of less susceptible pine species or pest tolerant varieties can also help in the control of this pathogen (EPPO/CABI, 1997; Hildebrand, 2005).

References

European and Mediterranean Plant Protection Organization (EPPO)/CAB International (CABI). 1997. *Quarantine pests for Europe*, 2nd edition, Smith, I.M., McNamara, D.G., Scott, P.R. & Holderness, M., eds., Wallingford, UK, CABI International, 1425 pp.

Hildebrand, D.M. 2005. *Mycosphaerella pini*. NAFC-ExFor Pest Report. Created 1998, modified 2005. (available at: www.spfnic.fs.fed.us/exfor/data/pestreports.cfm?pestidval=39&langdisplay=english)

Peterson, G.W. 1982. *Dothistroma needle blight of pines*. Forest Insect & Disease Leaflet 143, USDA Forest Service. Available at: www.na.fs.fed.us/spfo/pubs/fidls/dothistroma/doth.htm