JOURNAL OF FOREST SCIENCE, 50, 2004 (7): 319–326

Dothistroma needle blight *Mycosphaerella pini* E. Rostrup, a new quarantine pathogen of pines in the CR

L. JANKOVSKÝ, M. BEDNÁŘOVÁ, D. PALOVČÍKOVÁ

Faculty of Forestry and Wood Technology, Mendel University of Agriculture and Forestry, Brno, Czech Republic

ABSTRACT: Dothistroma needle blight caused by *Mycosphaerella pini* E. Rostrup was observed for the first time in the Czech Republic on an imported *Pinus nigra* Arnold in 1999. In 2000, it was also found in the open planting. During three years, it became an important pathogen of pines in the Czech Republic. Its occurrence was noticed in more than 50 localities, above all in the region of Moravia and Silesia and eastern Bohemia. In total, it was found on 10 species of pine (*P. nigra* Arnold, *P. banksiana* Lamb., *P. contorta* Loudon, *P. mugo* Turra, *P. leucodermis* Ant., *P. sylvestris* L., *P. cembra* L., *P. aristata* Engelm., *P. ponderosa* P. et C. Lawson and *P. jeffreyi* Grev. et Balf.). Also *Picea pungens* Engelm. was noticed as a host species. In the Czech Republic, *Pinus nigra* is the most frequent host species of *M. pini* (80% localities) followed by *Pinus mugo* (27% localities). On Scots pine *P. sylvestris*, *M. pini* was noticed at two localities. The critical period for infection is in the Czech Republic from the second half of May until the end of June. The incubation period lasts about 2–4 months depending on climatic conditions. The first symptoms on the needles infected in the current year appear in August being clearly expressed from September to November. In the CR, Dothistroma needle blight spread probably with infected planting stock obtained from import at the end of the 80s and at the beginning of the 90s.

Keywords: Dothistroma needle blight; *Mycosphaerella pini*; *Dothistroma septospora*; *Pinus*; needle cast; quarantine pests; *Picea pungens*

Dothistroma needle blight is caused by the fungus *Mycosphaerella pini* E. Rostrup apud Munk (syn. *Schirria pini* Funk & Parker). It is also known by its asexual state name *Dothistroma septospora* (Dorog.) Morelet (syn. *Dothistroma pini* Hulbary). It is one of the best known and most studied needle casts of pines and has caused extensive damage and defoliation of pines in many parts of the world (GIBSON 1972). The pathogen is native on pines in the northern hemisphere and was first recognized and described from Europe in 1911 (GIBSON 1972) but it prefers subtropical regions and mountain regions of the tropics. The origins of the pathogen are unclear. IVORY (1994) suggested that *Dothistroma pini* has been found to be indigenous to pine forests in Nepal, and it may be endemic in the Himalayas. Alternatively, it is supposed that the needle blight originates from mountain regions of Central America (Honduras, Guatemala) at altitudes 1,600–2,200 m. The early reports described the fungus both in Europe and the USA prior to the 1920s, although it was not recognized as a serious pathogen until the 1960s (BRADSHAW et al. 2000 in BROWN et al. 2003). Together with the development of market with planting stock, rapid spread of the needle blight occurred. Thus, the Dothistroma needle blight has become one of the most important diseases of pines worldwide. At present, it is a common pathogen in North America, South America, Central America, Africa, Asia, Oceania and Europe. Dothistroma needle blight is now distributed worldwide, and has been reported in at least 45 countries (BROWN et al. 2003).

In most cases where this disease has imparted serious losses, the pathogen has been introduced; optionally the hosts have been planted outside of its natural environment. *M. pini* was reported from 12 tropical countries, especially from derelict research plots and abandoned plantations (IVORY 1994). In some mountain regions of subtropics and tropics, it is a limiting factor for growing pines. A particularly susceptible species is the commercially most distributed species *Pinus radiata* D. Don.

Dothistroma needle blight affects many species of conifers, but 2-, 3- and 5-needled pines are the most common hosts. Apart from pines, other coniferous species such as European larch (*Larix decidua*), Norway spruce (*Picea abies*), sitka spruce (*Picea sitchensis*) and Douglas fir (*Pseudotsuga menziesii*) are occasionally susceptible. In total, over 60 pine species are reported to be prone to infection (BROWN et al. 2003).

Supported by the Ministry of Education, Youth and Sports of the Czech Republic, Project No. MSM 434100005.

In Europe, Dothistroma needle blight occurs above all in countries south of the Czech Republic (Croatia, Italy, France, Hungary, Spain, France, Switzerland, etc.). In the Czech Republic, the first record originates from *Pinus nigra* Arnold imported from Hungary in 1999. In plantings in the open, it was observed at the first time in the plantation of Christmas trees *Pinus nigra* Arnold near Jedovnice about 30 km north of Brno in May 2000 (JANKOVSKÝ et al. 2000). At that time, it was already known from a number of European countries including Austria (PETRAK 1961), France (in 1966; VILLEBONE, MAUGARD 1999 in BROWN et al. 2003), Slovenia (MACEK 1975), Germany (BUTIN, RICHTER 1983), Poland (KOWALSKI, JANKOWIAK 1998) where it was found in May 1990, Slovakia (KUNCA, FOFFOVÁ 2000) and Hungary (KOLTAY 1997).

During a relatively short period, Dothistroma needle blight was detected on a number of localities and as compared with the original expectation it became one of the most important quarantine organisms in the CR. In the course of three years, a number of focuses was noticed above all in the region of Moravia, Silesia and eastern Bohemia.

Mycosphaerella pini E. Rostrup (syn. *Scirrhia pini* Funk et Parker), anamorph *Dothistroma septospora* (Dorog.) Morelet, syn. *Dothistroma pini* Hulbary, *Cytosporina septospora* Dorog. was rearranged to a new genus *Eruptio* as *Eruptio pini* (Rostr. apud Munk) M. E. Barr (BARR 1996) in 1996. This new name is not usual in phytopathological literature and a former classification into the genus *Mycosphaerella* is used so far. However, using a name for the anamorphic stage of *Dothistroma septospora* is more exact, when a teleomorphic stage is very rare being unknown in some regions.

The most common symptoms of Dothistroma needle blight are red strips on needles where acervuli are formed amounting to 1–30 per needle. Their vicinity is characterized by more or less marked terracotta colouring. Conidia are filamentary at length with 1–5 (7) partitions and 8–32 (40) × 2–3 μm in size. On the basis of variability of conidia a number of varieties was described. Ascospores are hyaline, bicellular, obtuse-rounded, 7.5–14 × 2–3.5 μm in size. In addition to typical articulate conidia, spermogonia of *Asteromella* synanamorph are also formed 3 × 1 μm in size. Ascospores are noticed only exceptionally; from a number of regions, teleomorphic fruit bodies are unknown.

Infection permeates into plants through stomata. Incubation time differs according to local conditions. While under conditions of subtropics the time can take 6 weeks, under European conditions incubation lasts 3–6 months. Dothistroma needle blight is most frequent in plants, young plantations and particularly in Christmas tree plantations until about 10–20 years of age. Under favourable conditions, it attacks all needle year-classes and causes total defoliation of infected individuals.

Symptoms of infection are variable in dependence on a host species. Needle attack of the lower third up to two thirds of a crown is characteristic. Needles suddenly die similarly as in case of an attack by more common blights *Lophodermium pinastri* (Schrad.) Chev. and *L. seditiosum* Minter, Staley et Millar. The phenomenon is conspicuous in the course of April to June. At that time, it is possible to find verrucose formations on last year's needles and needles formed in the year before last. Under the formations, subepidermal acervuli are formed.

The aim of the paper is to evaluate the present occurrence, the host spectrum, symptomatology and bionomy of the needle blight in the region of the CR.

MATERIAL AND METHODS

Within monitoring carried out in 2000–2003, pine needle samples were examined taken mainly in the region of southern and central Moravia, Silesia and eastern and central Bohemia. Individually also from other regions of the CR. Samples were taken with symptoms of damage to the assimilatory apparatus of pines.

Mycosphaerella pini was detected on the basis of the occurrence of external symptoms of infection and according to morphology of fructification organs. The host spectrum and dynamics were studied of the development of infection symptoms in the course of the year.

Specimens are deposited in the herbarium of the Department of Forest Protection, Faculty of Forestry and Wood Technology, Mendel University of Agriculture and Forestry Brno (BRNL).

RESULTS AND DISCUSSION

Symptoms of *M. pini* infection under conditions in the CR

Typical manifestations related to needle dying of the lower part of a crown and the abundant occurrence of red strips on dead tissues of needles were noticed in the CR primarily on Austrian pine *Pinus nigra.* Typical symptoms were, however, also formed in other pines, viz. *P. banksiana* Lamb., *P. contorta* Dougl. ex Loud., *P. aristata* Engelmann etc. Dying the needle tips shows markedly in susceptible *P. ponderosa* and particularly *P. jeffreyi*.

Dwarf pine *Pinus mugo* gets dry in the whole crown and, therefore, it is not possible to differentiate the attacked lower third as in *Pinus nigra*. Thus, the typical needle tip dying is not so evident. Rusty strips are rather formed on needles. The strips then enlarge and acervuli begin to form. Characteristic red strips occur only on quite dead needles.

On Swiss stone pine *Pinus cembra* var. *sibirica* L. from Kunovice locality, a typical dying of needle tips, formation of acervuli and drying the lower part of a crown occurred at the end of March 2003. Similarly as on *Pinus mugo* from the same locality, characteristic red strips were not formed there. In mid-March, hyaline articulate conidia with 2–3 partitions released from acervuli. Conidia with 1 partition were not an exception.

On Scots pine *Pinus sylvestris*, typical red strips were formed sporadically on fallen needles only. Infected nee-

dles get yellow prematurely and individual brown spots are formed. Acervuli were noticed only on fallen needles and exceptionally on dead needles of twigs. Needle tip dying is not marked.

Bionomy of *M. pini* in the Czech Republic

The open acervuli of *M. pini* were noticed in the majority of localities in the CR already from mid-March in the year 2002. In some localities, the formation of conidia was noticed from the end of April. The critical period for infection is in the Czech Republic from the second half of May until the end of June (beginning of July). The incubation period lasts about 2–4 months depending on climatic conditions.

The first symptoms on the needles infected in the current year appear in August in the form of unspecific yellow spots on needles. Finally, the needles get dry from tips and dead tissues are at first of straw-brown color. In the course of September, at first dark brown and later narrow black strips are formed on dead parts of needles. In this stage, fruit bodies are formed on needles in which conidia of *Asteromella* synanamorph are produced. On their place, acervuli are formed from October and characteristic red strips are created. In acervuli, *Asteromella* spermogonia can be formed at first together with conidia of the stage of *Dothistroma*. In this period, intensive development of infection occurs. During a week, a progress of damage to pines was noticed in localities under study. Infection demonstrations are particularly evident in early spring. Under strong infection pressure, needles die already during the year of infection, namely rather early, from August till September. In the same year, acervuli can be formed even with accompanying symptoms as the occurrence of red strips. Heavily infected trees are weakened to such an extent that sufficiently large new current year shoots are not often formed. If the shoots grow they are shortened and stunted ("lion tails") and during the next year, they die under the infection pressure.

Ascospores of *Mycosphaerella pini* were noticed only once on fallen needles of *Pinus mugo* from the Říkovice locality (district of Svitavy) in October 2001. In other localities, the ascospores were not noticed.

Results obtained correspond to observations of PETERSON (1967). Virtually the same results are given by KARADZIĆ (1989) from the region of Serbia. He mentioned that conidia of *Mycosphaerella pini* were in Serbia dispersed from the beginning of April until the end of October, and ascospores from the second half of June until the end of September.

In Germany, conidia of *M. pini* were detected between March and November being particularly abundant from April to June (LANG, KARADZIĆ 1987).

Evaluation of the species distribution in the Czech Republic

For the first time, *Mycosphaerella pini* was noticed in the Czech Republic in 1999 on *Pinus nigra* ssp. *austriaca* coming from Hungary within an inspection of imported

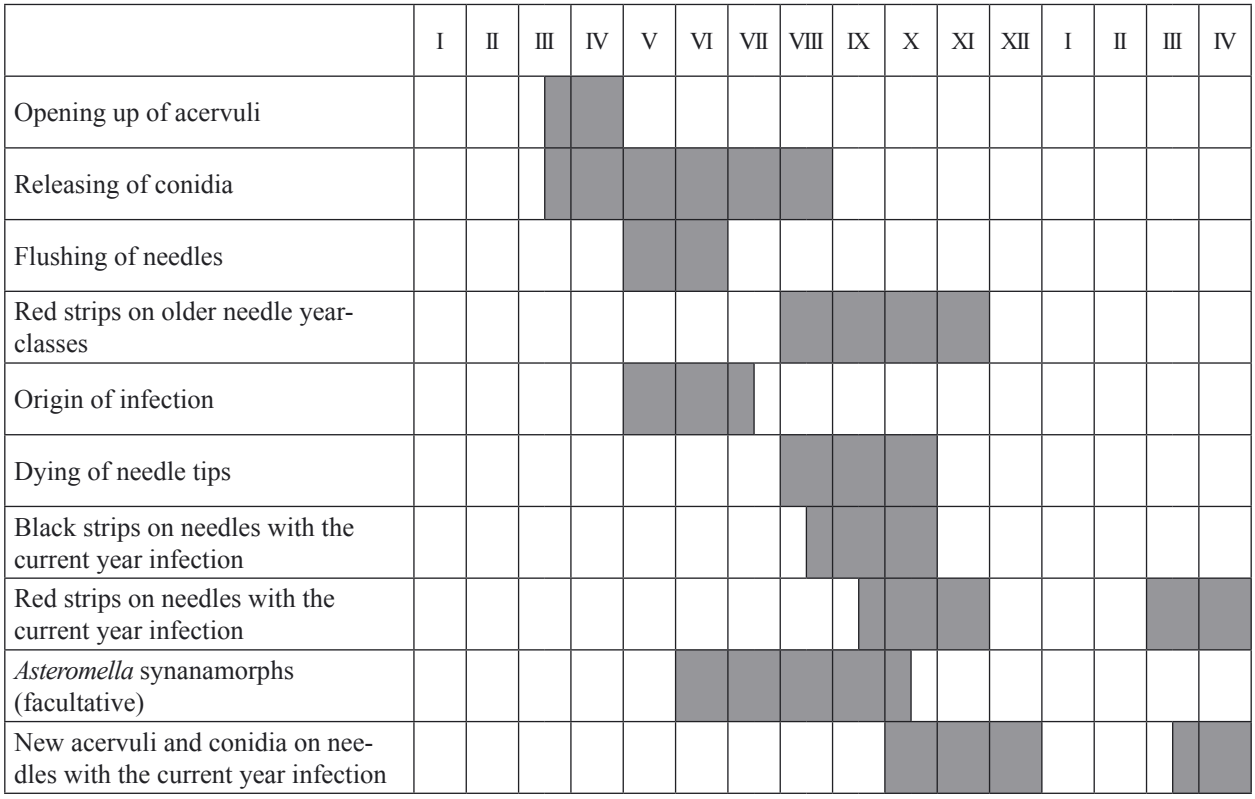

Fig. 1. Phenology of *Mycosphaerella pini* in the CR in the course of 2002–2003

Fig. 2**.** Distribution of *M. pini* in the Czech Republic

planting stock by State Phytosanitary Administration of the Czech Republic. In April 2000, a delivery of *Pinus mugo* infected by *M. pini* was detected in a border crossing Mosty u Jablunkova. The delivery originated again from Hungary. All imported planting stock was disposed of.

The first find of *M. pini* from an open planting was noticed in the CR 28th May 2000 in a Christmas trees plantation of *Pinus nigra* near Jedovnice in the region of the Křtiny Training Forest Enterprise. The locality is situated at an altitude of 460 m about 30 km north of Brno, along a road between villages Křtiny and Jedovnice. In the course of a further search, the needle blight was detected on Austrian pine also in some other localities in the vicinity (Olomučany, Adamov).

In June 2000, *M. pini* was detected in the weekend cottage settlement Kosová near Jackov about 6 km from Moravské Budějovice (altitude 480 m). On Austrian pine *Pinus nigra* and dwarf pine *Pinus mugo*, *M. pini* was also detected in an urban park in Moravské Budějovice (altitude 450 m).

In Bohemia, *M. pini* was first noticed 23rd June 2000 in Říkovice (altitude 350 m) about 10 km west of Litomyšl on *Pinus mugo* and also on *Pinus leucodermis* Antoine. One year later, *M. pini* was also detected in a forest nursery in Litomyšl and in some other localities in the vicinity.

In 2001–2003, the number of finds increased nearly according to a geometrical series. In some regions, *M. pini* appears to be virtually a common pathogen. While the southernmost boundary of its detected occurrence in the CR is in the vicinity of Valtice and in the Podyjí National Park near a border with Austria, the northernmost boundary is along a border with Poland in a village Mikulovice (the Jeseníky Mts.) and in eastern Bohemia, it is the Orlické hory Mts. foothills. More than 50 localities have been found. Often it is a case of large focuses in plantings of Austrian pine (Fig. 1). The following regions can be ranked among the main areas of occurrence: Valašsko, wooded spoil banks near Březina (district of Svitavy), plantings of Austrian pine near Koryčany (the Chřiby Mts.), plantings in the vicinity of Břeclav and Židlochovice etc. On the other hand, there is a minimum records from the region of southern, western and northern Bohemia. However, the fact can be a result of the intensity of surveys.

The distribution of Dothistroma needle blight was recently supported by the favourable development of weather in the 90s when long and dry periods alternated with humid and warm periods during the growing season. Above all, the high air humidity in a forest stand in combination with dry substrate create suitable conditions for the origin of infection.

Although the first find of *M. pini* is dated May 2000, according to the occurrence on older tees it is possible to estimate that the disease occurred on our territory as early as the 80s. Austrian pines planted at the end of the 80s and at the beginning of the 90s are damaged most. According to the existing experience, the disease spreads above all with a planting stock and it is possible to suppose that it was spread to the localities together with tree plants. The origin of plants was proved only in individual cases. Subsequent inspections in forest nurseries in 2001–2003 showed the occurrence of infection in a number of nurseries in the CR. The disease was spread into nurseries within trade with an imported planting stock.

Pine trees aged 5–20 years are affected most. On dwarf pine, Dothistroma needle blight was noticed even trees aged more than 40 years. On other pine species, the higher age of a host tree is an exception. In spite of this, *M. pini* was detected on *Pinus ponderosa* and *Pinus nigra* aged about 25–30 years. Infection was noticed only on the

lowest branches there. The oldest tree of Austrian pine with detected infection was about 80 years old (arboretum Řícmanice, Training Forest Enterprise Křtiny). Infection detected on a tree of such an age is an absolute exception. Only needles of the lower whorl were infected. In this case, age and origin of the infection appear to be a question. A significant source of infection was not located in the vicinity of the tree. It is not possible to exclude that the disease was neglected in the Czech Republic for decades.

On needles of pines, also other needle blight species were abundantly detected such as *Lophodermium pinastri* (Schrad.) Chev. or *Lophodermium seditiosum* Minter, Staley et Millar, *Cyclaneusma minus* (Butin) Di Cosmo, Peredo et Minter and *Cyclaneusma niveum* (Person: Fries) Di Cosmo, Peredo et Minter, *Sphaeropsis sapinea* (Fr.: Fr.) Dyko & Sutton in Sutton, further *Sclerophoma pithyophila* (Corda) Höhn, *Pestalotia hartigii* Tubeuf, *Coleosporium* sp. div. and *Phacidium infestans* P. Karsten. As for *Phacidium infestans* from localities Říkovice near Litomyšl and Deštné in the Orlické hory Mts., it was the first record in the CR.

List of some localities

1. Adamov (Blansko district, alt. 350 m), *Pinus nigra*, garden, March 2001
2. Borová u Poličky (Svitavy distr., alt. 600 m), *Pinus nigra,* May 2003
3. Březina u Jevíčka (Svitavy distr., alt. 500 m), *Pinus nigra*, *P. banksiana, P. contorta, P. rotundata, P. sylvestris,* March 2001–December 2003
4. Březina u Tišnova (Brno-venkov distr., alt. 280 m), *Pinus nigra, Pinus mugo*, amenity trees, May 2002
5. Brno-Černá pole, Durďákova str. (Brno-město distr., alt. 300 m), *Pinus mugo*, March 2003
6. Brno-Soběšice (Brno-město distr., alt. 350 m), *Pinus ponderosa,* garden, May 2001
7. Brno, autocamping Osada (Brno-venkov distr., alt. 330 m), *Pinus nigra*, amenity trees, May 2001
8. Budišov (Třebíč distr., alt. 350 m) *Pinus nigra, P. ponderosa*, nursery, June 2003
9. Bystřička (Vsetín distr., Vsetínské vrchy, alt. 500 m), *Pinus nigra, Pinus mugo*, amenity trees, June 2000, July 2001
10. Jackov, ca 6 km from Moravské Budějovice (Třebíč distr., alt. 480 m), *Pinus nigra*, soliter, June 2000
11. Jalubí (Uherské Hradiště distr., alt. 230 m), *Pinus nigra*, amenity tree nursery, May 2001
12. Jasenice (Vsetín distr., alt. 450 m), *Pinus nigra*, quarry, May 2001
13. Jedovnice (Blansko distr., alt. 430 m), *Pinus nigra*, May 2000
14. Jeseník, Bukovice (Jeseník distr., alt. 550 m), *Pinus ponderosa*, garden, October 2001
15. Josefovské údolí, Hostinec u Kamenného kola (Blansko distr., alt. 350 m), *Pinus nigra, Pinus mugo,* amenity trees, April 2001
16. Kamenec u Poličky (Svitavy distr., alt. 550 m), *Pinus nigra*, amenity trees, March 2003
17. Kamenice nad Lipou (Pelhřimov distr., alt. 520 m), *Pinus nigra*, amenity trees, June 2002
18. Karviná-Darkov (Karviná distr., alt. 400 m), *Pinus mugo*, April 2003
19. Koroužné (Žďár nad Sázavou distr., alt. 480 m), *Pinus nigra*, garden, June 2000
20. Koryčany (Uherské Hradiště distr., alt. 300 m), *Pinus nigra*, plantation, February 2002
21. Křtiny, arboretum (Blansko distr., alt. 450 m), *Pinus ponderosa*, March 2003
22. Křtiny, by the pond (Blansko distr., alt. 430 m), *Pinus nigra*, March 2003
23. Kunovice Forestry and Game Management Research Institute (Uherské Hradiště distr., alt. 320 m), *Pinus nigra*, *Pinus mugo*, *Pinus cembra* var. *sibirica*, *Pinus aristata*, amenity trees, March 2003
24. Kunvald (Ústí nad Orlicí distr., alt. 500 m), *Pinus nigra*, amenity trees, June 2002
25. Lednice-Castle garden (Břeclav distr., alt. 220 m), *Pinus aristata*, amenity trees, April 2002
26. Lhotka nad Bečvou (Vsetín distr., alt. 350 m), *Pinus nigra*, Christmas-tree plantations, May 2001
27. Litomyšl (Svitavy distr., alt. 350 m), *Pinus nigra, P. mugo, P. ponderosa, P. leucodermis, P. jeffreyi,* amenity tree nursery, May 2001
28. Litovel (Olomouc distr., alt. 220 m), *Pinus nigra*, *Pinus mugo* and *Pinus ponderosa*, amenity trees, June 2000
29. Lomnice u Tišnova (Blansko distr., alt. 400 m), *Pinus nigra,* November 2003
30. Luže (Chrudim distr., alt. 400 m), *P. nigra, Pinus sylvestris,* May 2003
31. Malá Bystřice (Vsetín distr., alt. 450 m), *Pinus nigra*, garden, May 2001
32. Mikulovice (Jeseník distr., alt. 600 m), *Pinus nigra*, amenity tree, October 2001
33. Moravské Budějovice (Třebíč distr., alt. 450 m), city park, *Pinus nigra, Pinus mugo*, June 2000
34. Morkovice (Kroměříž distr., alt. 280 m), *Pinus nigra,* May 2003
35. Náměšť nad Oslavou (Třebíč distr., alt. 380 m), *Pinus mugo*, amenity trees, March 2003
36. Oldříš (Svitavy distr., alt. 550 m), *P. nigra, P. mugo,* May 2003
37. Olomučany (Blansko distr., alt. 400 m), *Pinus nigra*, plantings, May 2000
38. Pelhřimov (Pelhřimov distr., alt. 450 m), *Pinus nigra,* amenity trees, May 2001
39. Polička, Liboháj (Svitavy distr., alt. 550 m), *Pinus nigra,* May 2003
40. Praha-Průhonice (Praha-east distr, alt. 320 m), *Pinus nigra, P. mugo, P. jeffreyi,* September 2002
41. Řícmanice (Blansko distr., alt. 500 m), arboretum, *Pinus nigra, P. aristata*, March 2003
42. Říkovice by Litomyšl (Svitavy distr., alt. 350 m), *Pinus mugo, Pinus leucodermis,* private garden, June 2000

43. Sádek u Poličky (Svitavy distr., alt. 550 m), *Pinus ponderosa*, *Pinus mugo, Pinus nigra*, amenity trees, March 2003
44. Soutok game preserve by the Dyje river (Břeclav distr., alt. 250 m), *Pinus nigra*, March 2003
45. Tišnov (Brno-venkov distr., alt. 380 m), *Pinus nigra, Pinus jeffreyi,* November 2003
46. Tři Grácie, Lednice (Břeclav distr., alt. 220 m), *Pinus nigra*, amenity trees, March 2002
47. Uherčice (Znojmo distr., alt. 370 m), *Pinus nigra,* May 2003
48. Ujčov (Žďár nad Sázavou distr., alt. 450 m), *Pinus nigra*, garden, May 2001
49. Veverská Bitýška (Brno-venkov distr., alt. 330 m), *Pinus nigra*, soliter, June 2000, November 2003
50. Vranov nad Dyjí (Znojmo distr., alt. 320 m), *Pinus nigra,* June 2003
51. Vsetín (Vsetín distr., alt. 400 m), *Pinus nigra*, park, May 2001
52. Židlochovice, pheasantry Knížecí les, U staré boudy (Brno-venkov distr., alt. 250 m), *Pinus nigra*, *Picea pungens*, March 2003

Host spectrum

The most frequent host of *M. pini* in the Czech Republic is *Pinus nigra* (80% registered localities) followed by dwarf pine *Pinus mugo* (27% localities). Three-needle pines *Pinus ponderosa* and *Pinus jeffreyi* have to be also included to important host species under conditions of the CR.

The occurrence of *M. pini* on dwarf pine *Pinus mugo* is not so important but is frequent. For the present, infection was found only in ornamental plantings at lower altitude. In stands above the upper forest limit (timber line), the needle blight has not been detected for the present. Plantings of young plants grown in forest nurseries at lower locations represent, however, an important risk of spread similarly as in Germany (PEHL, BUTIN 1992).

Mycosphaerella pini was first recorded on *Pinus sylvestris* on fallen needles at the Březina locality as late as in spring 2002. The find was also confirmed on needles from the lower whorls of Scots pine from the locality Luže in the district of Chrudim. So far, Dothistroma needle blight does not cause damage to *Pinus sylvestris* as to *Pinus nigra* or symptomatic is a little different and characteristic symptoms with the development of red strips are formed only rarely and predominantly as lately as on fallen needles. It is also possible to note that in the studied localities with the verified occurrence of *M. pini* on Scots pine the infection pressure from infected Austrian pines was huge.

On *Pinus banksiana* which can be substituted for Scots pine Dothistroma needle blight was detected in several localities. Infected trees occurred most frequently in plantings of Austrian pine *Pinus nigra*. The degree of damage was comparable with damage to *Pinus nigra*.

Mycosphaerella pini was also detected on about a 25 years old blue spruce *Picea pungens* in an ornamental planting in the Knížecí les pheasantry in Židlochovice. Dead needles showed characteristic red bands and fruit bodies with conidia. The infection is connected with a favourable microclimate and high infection pressure. In the close vicinity, there are infected Austrian pines which can be considered to be the source of infection.

In the neighbouring Germany, *M. pini* is mentioned on 16 species of pine (LANG, KARADZIĆ 1987). No damage to *P. sylvestris* worth mentioning was observed in the field. As for spruce KARADZIĆ (1994) mentions Dothistroma needle blight on *Picea omorica* from the region of Serbia. It was also noticed on *Pseudotsuga menziesii*. On Norway spruce *Picea excelsa*, *M. pini* was detected in Bavaria in 6-year-old plants (LANG 1987).

CONCLUSION

Dothistroma needle blight caused by *Mycosphaerella pini* became an important pathogen of pines in the Czech Republic in the course of several years. Introduced *Pinus nigra* aged 5–20 years is most affected. On the hand, on the domestic Scots pine *P. sylvestris*, *M. pini* was noticed sporadically. In total, it was detected on 10 species of pines, 6 of which were two-needle pines (*P. nigra, P. banksiana, P. contorta, P. mugo, P. leucodermis, P. sylvestris*), five-needle pines included 2 species (*P. cembra, P. aristata*) and three-needle pines also 2 species (*P. ponderosa* and *P. jeffreyi*). Also blue spruce *Picea pungens* was noticed as a host species. Infection spread

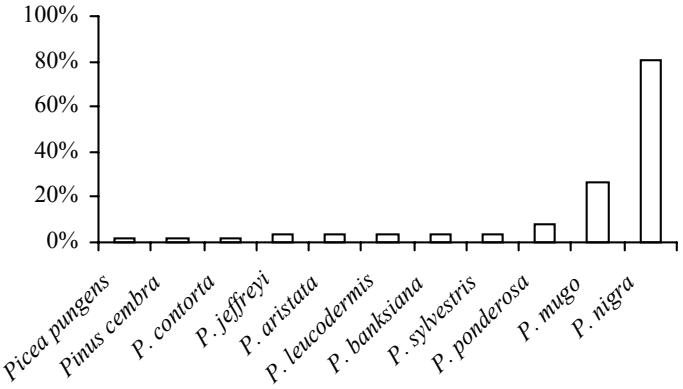

Fig. 3. *Mycosphaerella pini* according to the frequency of localities and hosts

probably with an infected planting stock in the CR already at the end of the 80s and at the beginning of the 90s. However, it is not possible to exclude that the disease is neglected in the region of the CR already for several decades. Only inclusion into quarantine organisms brought about an interest in the pathogen. Roughly at the same time as in the Czech Republic, the disease was also noticed in neighbouring countries. The spread of Dothistroma needle blight can be considered (in addition to trade with planting stock) to be the result of favourable climatic conditions when natural geographic and climatic barriers preventing the spread of the disease towards north were removed.

References

BARR M.E., 1996. *Planistromellaceae*, a new family in the *Dothideales*. Mycotaxon, *LX*: 433–442.

BROWN A., ROSE D., WEBBER J., 2003. Red Band Needle Blight of Pine. Forestry Commission, Information note 049.

BUTIN H., RICHTER J., 1983. Dothistroma – Nadelbräune, eine neue Kiefernkrankheit in der Bundesrepublik Deutschland. Nachr.-Bl. Dtsch. Pfl.-Schutzdients, *35*: 129–131.

GIBSON I.A.S., 1972. Dothistroma blight of *Pinus radiata*. Ann. Rev. Phyt., *10*: 51–72.

IVORY M.H., 1994. Records of foliage pathogens of *Pinus* species in tropical countries. Plant Path., *43* (3): 511–518.

JANKOVSKÝ L., ŠINDELKOVÁ M., PALOVČÍKOVÁ D., 2000. Karanténní sypavky *Mycosphaerella pini* a *M. dearnessii*. Lesn. Práce, *79*: 370–372.

KARADZIĆ D., 1989. *Scirrhia pini* Funk et Parker. Life cycle of the fungus in plantations of *Pinus nigra* Arn. in Serbia. Eur. J. For. Path., *19* (4): 23– 236.

KARADZIĆ D., 1994. *Picea omorica* – a new host of *Dothistroma septospora*. Eur. J. For. Path., *24* (5): 300–303.

KOLTAY A., 1997. New pathogens in Hungarian black pine stands. Novenyvedelem, *33* (7): 339–341.

KOWALSKI T., JANKOWIAK R., 1998. First record of *Dothistroma septospora* (Dorog.) Morelet in Poland: a contribution to the symptomatology and epidemiology. Phyt. Pol., *16*: 15–29.

KUNCA A., FOFFOVÁ E., 2000. Ohrozenie porastov borovice čiernej fytokaranténnym patogénom *Dothistroma septospora* (Dorog.) Morelet. In: VARÍNSKY J. (ed.), Aktuálne problémy v ochrane lesa 2000. [Zborník.] Zvolen, Lesnícky výskumný ústav: 136–139.

LANG K. J., 1987. *Dothistroma pini* an jungen Fichten (*Picea abies*). Eur. J. For. Path., *17* (4–5): 316–317.

LANG K.J., KARADZIĆ D., 1987. *Dothistroma pini* – eine Gefahr für *Pinus sylvestris*? Forstwiss. Cbl., *106* (1): 45–50.

MACEK J., 1975. *Scirrhia pini*, the pathogen of a new disease of pine in Slovenia. Gozd. Vestnik, *33* (1): 9–11.

PEHL L., BUTIN H., 1992. *Dothistroma septospora*, ein neuer Schadpilz an der Bergkiefer. Allg. Forstz., *47* (14): 758–760.

PETERSON G. W., 1967. Dothistroma needle blight of Austrian and Ponderosa pines: epidemiology and control. Phytopathology, *57* (4): 437–441.

PETRAK F., 1961. Die Lecanostict Krankheit der Föhren in Österreich. Sydowia, *15*: 252–256.

Received for publication January 8, 2004
Accepted after corrections April 13, 2004

Červená sypavka borovic *Mycosphaerella pini* E. Rostrup, nový karanténní patogen borovic v ČR

L. JANKOVSKÝ, M. BEDNÁŘOVÁ, D. PALOVČÍKOVÁ

Lesnická a dřevařská fakulta, Mendelova zemědělská a lesnická univerzita, Brno, Česká republika

ABSTRAKT: *Mycosphaerella pini* byla v ČR poprvé zjištěna v roce 1999 na importované *Pinus nigra*, v roce 2000 byla objevena i ve volné výsadbě. V průběhu tří let se stala významným patogenem borovic v České republice. Výskyt byl zaznamenán na více než 50 lokalitách především v oblasti Moravy, Slezska a východních Čech. Celkem byla zjištěna na deseti druzích borovic (*P. nigra, P. banksiana, P. contorta, P. mugo, P. leucodermis, P. sylvestris*, *P. cembra, P. aristata, P. ponderosa* a *P. jeffreyi)* a na smrku pichlavém (*Picea pungens*). Nejčastějším hostitelem *M. pini* v České republice je *Pinus nigra* (80 % lokalit), následovaná klečí *Pinus mugo* (27 % lokalit). Na borovici lesní *P. sylvestris* byla *M. pini* pozorována na dvou lokalitách. *M. pini* se v ČR pravděpodobně rozšířila již koncem 80. a počátkem 90. let s infikovaným sadebním materiálem z dovozu.

Klíčová slova: červená sypavka borovic; *Mycosphaerella pini*; *Dothistroma septospora*; *Pinus*; sypavka; karanténní škůdci; *Picea pungens*

Mycosphaerella pini byla poprvé v České republice zaznamenána v roce 1999 na *Pinus nigra* ssp. *austriaca* původem z Maďarska v rámci kontroly dováženého rostlinného materiálu. První nález *M. pini* z volné výsadby byl v ČR zaznamenán 28. května 2000 na plantáži vánočních stromků *Pinus nigra* u Jedovnice na ŠLP Křtiny. V Čechách byla *M. pini* poprvé zjištěna v obci Říkovice (350 m n. m.), asi 10 km západně od Litomyšle na borovici kleči *Pinus mugo* a rovněž na borovici bělokoré *Pinus leucodermis*.

V letech 2001–2003 rychle narůstal počet nálezů. V některých oblastech ČR je *M. pini* prakticky běžným patogenem. Zatímco nejjižnější hranice zjištěného výskytu je v ČR v okolí Valtic a v NP Podyjí nedaleko hranic s Rakouskem, nejsevernější hranice jsou naopak na hranicích s Polskem v obci Mikulovice na Jesenicku, ve východních Čechách pak podhůří Orlických hor. Bylo zjištěno více než 50 lokalit, často jde o velká ohniska ve výsadbách borovice černé (obr. 1). Mezi hlavní oblasti výskytu je možné počítat Valašsko, zalesněné výsypky u obce Březina v okrese Svitavy, výsadbu borovice černé u obce Koryčany v Chřibech, Břeclavsko, okolí Židlochovic aj. Naproti tomu je dosud minimum záznamů z oblasti jižních, západních a severních Čech.

Nejvíce jsou postiženy borovice ve věku 5–20 let. U borovice kleče byla *M. pini* pozorována i u jedinců starších 40 let, u jiných druhů borovic je vyšší věk hostitele výjimkou. Přesto byla *M. pini* zjištěna na *Pinus ponderosa* a *Pinus nigra* ve věku asi 25–30 let. Infekce zde byla pozorována pouze na nejspodnějších větvích. Nejstarší jedinec borovice černé se zjištěnými projevy infekce byl asi 80letý (arboretum Řícmanice, ŠLP Křtiny). Infekce na takto starém jedinci je naprostou výjimkou. Infikovány byly pouze jehlice spodního přeslenu. V tomto případě je stáří a původ infekce otázkou; v okolí nebyl zjištěn významný zdroj infekce. Nelze vyloučit, že tato choroba byla v České republice po desetiletí přehlížena.

Na jehlicích borovic byly v rámci diagnostiky *M. pini* hojně zjištěny i další druhy sypavek a houbových chorob jako *Lophodermium pinastri*, resp. *Lophodermium seditiosum*, *Cyclaneusma minus* a *Cyclaneusma niveum*, *Sphaeropsis sapinea*, dále *Sclerophoma pithyophila*, *Pestalotia hartigii*, *Coleosporium* sp. div. a *Phacidium infestans*. U *Phacidium infestans* z lokalit Říkovice u Litomyšle a Deštné v Orlických horách šlo o první nález v rámci ČR.

Nejčastějším hostitelem *M. pini* v České republice je *Pinus nigra* (80 % zaznamenaných lokalit), následovaná klečí *Pinus mugo* (27 % lokalit). K významnějším hostitelům v podmínkách ČR je nutné přiřadit také tříjehličkové borovice *Pinus ponderosa* a *Pinus jeffreyi*. Na *Pinus sylvestris* byla *Mycosphaerella pini* poprvé zjištěna až na jaře roku 2002 na opadlém jehličí na lokalitě Březina na Svitavsku a u Chrudimi. Na *Pinus banksiana*, která může být za borovici lesní zaměněna, byla *M. pini* zjištěna na několika lokalitách. Celkem byla zjištěna na deseti druzích borovic, z toho bylo šest dvoujehličkových (*P. nigra, P. banksiana, P. contorta, P. mugo, P. leucodermis, P. sylvestris*), po dvou druzích jsou zastoupeny borovice pětijehličkové (*P. cembra* var. *sibirica, P. aristata*) a tříjehličkové (*P. ponderosa* a *P. jeffreyi)*. Jako hostitelská dřevina byl zaznamenán i smrk pichlavý *Picea pungens*.

Mycosphaerella pini se stala v průběhu několika let významným patogenem borovic v České republice. Infekce se v ČR pravděpodobně rozšířila již koncem osmdesátých a počátkem devadesátých let s infikovaným sadebním materiálem. Šíření červené sypavky je možné přičítat vedle obchodu s rostlinným materiálem také příznivým klimatickým podmínkám, kdy byly odbourány přirozené geografické a klimatické bariéry, které dosud bránily šíření choroby na sever.

Corresponding author:

Dr. Ing. LIBOR JANKOVSKÝ, Mendelova zemědělská a lesnická univerzita, Lesnická a dřevařská fakulta, Lesnická 37, 613 00 Brno, Česká republika
tel. + fax: + 420 545 134 116, e-mail: jankov@mendelu.cz