New Disease Reports

Outbreak of Swiss needle cast caused by the fungus *Phaeocryptopus gaeumannii* on Douglas-fir in Spain

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In April 2012, a forest owner from Sant Hilari Sacalm (Girona, NE Spain) reported chlorosis and defoliation symptoms in a twelve-year-old Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*) plantation located at 41º 52' 30" N, 2º 28' 4" E (Fig. 1). Black and globose pseudothecia were observed on the undersides of the needles. Pseudothecia were 50-80 µm in diameter and contained asci with septate spores sized 30-40 x 8-15 µm, matching well with the description of *Phaeocryptopus gaeumannii* (Rohde) Petrak (Ellis & Ellis, 1997). In January 2013, the plantation was inspected in detail and revealed clear symptoms of Swiss needle cast (SNC). Infected trees had only current-year needles and showed chlorotic foliage. Some of the trees were badly disfigured, at times being completely defoliated (Fig. 2). Fungal isolations from infected needles were performed on selective 2% malt extract agar amended with chloramphenicol (200 mg/l). The identity of *P. gaeumannii* was confirmed by amplifying the ITS region from extracted genomic DNA. Sequence data from the purified amplicon (GenBank Accession No. KF746186) was searched against the NCBI nucleotide sequence database. Nucleotide sequence data showed a 99% nucleotide homology with several *P. gaeumannii* isolates reported in the database (JN408849 and JN408851). Isolates and herbarium material were deposited at the University of Lleida under the accession numbers PF328 and PF329.

In April 2013, ten Douglas-fir plantations (6-12 years old) in the same county were inspected (Fig. 3). Growth rate of infected trees was studied measuring the last four years' growth in two branches from each of three randomly chosen trees in each stand. We observed growth losses occurring when the pathogen was prevalent on needles that were one or two years old (classes 5 to 7 in Table 1) as previously reported (Kimberley *et al*., 2011). Inspected stands had an average disease severity of 30% (trees in class 5 or higher). *P. gaeumannii* is a common endophyte on Douglas-fir. Although the fungus had been observed in Spain (Muñoz López *et al*., 2003), to our knowledge this is the first report of *P. gaeumannii* causing a significant SNC disease outbreak. Douglas-fir is a valued species currently planted by forest owners in Spain, who regard it as highly productive and free of disease problems. The possibility of outbreaks has to be considered when planning new plantations due to the volume growth reductions that occur in SNC cases with severe defoliation (Kimberley *et al*., 2011).

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Figure 1

Figure 2

Figure 3

Table 1: Current-year shoot growth and disease severity (damage class) in ten Douglas-fir plantations in Spain. Means of growth rate followed by the same letter within a column were not significantly different at $p<0.01$ (Tukey's HSD test).

Damage class*	Number of measured shoots	Growth rate (cm)
1	0	-
2	32	22.6 a
2-3	8	22.4 a
3	48	27.0 a
3-4	24	27.5 a
4	56	22.2 a
4-5	32	12.3 b
5	8	7.8 b
6	8	10.2 b
6-7	23	8.6 b

*1=no signs of *P. gaeumanii*, 2=presence of *P. gaeumanii* but no defoliation in needles younger than 4 years, 3=no defoliation on current or previous-year needles, 4=slight defoliation (<50%) on previous-year needles, 5=high defoliation (>50%) on previous year needles, 6=high defoliation (>50%) in current-year needles, 7=very high (>90%) defoliation on current-year needles or dead tree).

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