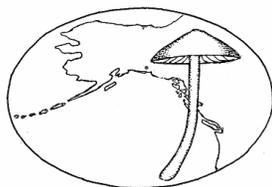


Pacific Northwest Fungi



Volume 2, Number 4, Pages 1-6
Published April 11, 2007

New North American Records of Anamorphic Powdery Mildew Fungi (Erysiphales) Parasitizing Species of *Leucothoë* and *Limnanthes*

Melodie L. Putnam¹ and Dean A. Glawe²

¹ Extension Plant Pathologist, Oregon State University, Botany and Plant Pathology Department, Corvallis, OR 97331-2903. ² Plant Pathologist, Department of Plant Pathology, Washington State University, and Professor, College of Forest Resources, Box 352100, University of Washington, Seattle, WA 98195.

Putnam, M. L., and D. A. Glawe. 2007. New North American records of anamorphic powdery mildew fungi (Erysiphales) parasitizing species of *Leucothoë* and *Limnanthes*. *Pacific Northwest Fungi* 2(4): 1-6. doi: 10.2509/pnwf.2007.002.004

Corresponding author: Dean A. Glawe. glawe@wsu.edu. Accepted for publication April 2, 2007.
Copyright © 2007 Pacific Northwest Fungi Project. All rights reserved.

Abstract: This paper documents the presence of two species of Erysiphales previously unreported in North America. The fungi were encountered on greenhouse-grown host plants in Oregon during the 2006 growing season. *Oidium ericinum* was found on potted plants of *Leucothoë axillaris* (Ericaceae) grown at a wholesale nursery where it resulted in a substantial financial loss to the grower. *Oidium limnanthis* was found on potted plants of *Limnanthes alba* (Limnanthaceae) where it was associated with premature senescence of plants and reduced seed production. This appears to be the first record of a powdery mildew fungus parasitizing a member of the Limnanthaceae in North America. Both species are described and illustrated.

Key Words: *Oidium ericinum*, *Oidium limnanthis*, *Erysiphe azaleae*, *Erysiphe vaccinii*, *Microsphaera*, *Rhododendron*, plant disease diagnosis

Introduction: Powdery mildews, caused by members of the Erysiphales (Ascomycota), are widespread, frequently economically significant plant diseases. They are particularly problematic on ornamental landscape plants because their mycelia can spoil the appearance of the plants. As part of ongoing surveys for powdery mildew fungi in the Pacific Northwest, the authors encountered several additional unreported species of Erysiphales during 2006. This paper reports the presence of *Oidium ericinum* Erikss. and *Oidium limnanthis* Noordel., neither of which has been reported previously in North America.

Materials and Methods: Observations and photographs were made with a Leica DMR compound microscope equipped with brightfield and differential interference contrast optics and a Leica MZ95 stereo microscope. Both microscopes were equipped with Leica DC300 digital cameras. Images were acquired and processed using Image Pro Plus and Adobe Photoshop CS software. Specimens were deposited with the mycological herbarium in the Department of Plant Pathology, Washington State University, Pullman (WSP).

Results and Discussion

Oidium ericinum Erikss. on *Leucothoë axillaris* (Lam.) D. Don

Leucothoë axillaris (Ericaceae, common names: coast leucothoë, coastal doghobble) is a small shrub, valued for its glossy evergreen leaves. It is used in landscapes as hedge plants, specimens, and in mass plantings. In October, 2006 an outbreak of powdery mildew on *L. axillaris* occurred at a wholesale nursery in Washington County, Oregon, affecting 30,000 plants growing in

1-gallon pots. Symptoms (Figs. 1, 2) included yellowish to reddish, circular to irregular leaf spots that enlarged to cover entire leaves. As the disease progressed the leaves became necrotic. The powdery mildew fungus generally was confined to the abaxial surfaces beneath the leaf spots. The fungus produced hyphae with lobed appressoria that generally occurred in pairs (Fig. 3). Conidiophores (Fig. 4) produced cylindrical foot cells measuring (24.5-) 27.7-41.5 (-42.5) x 6-8 µm, with basal parts that were strongly curved, bent, or twisted. Conidia (Fig. 4) were produced singly and were subcylindric to ovoid, lacked fibrosin bodies, measured (31-) 33.5-45.5 (-47.5) x (12.5-) 14-16.5 (-20) µm, and germinated from a single germ tube produced at the end of the spore (Fig. 5). No teleomorph was present.

Morphological features of the fungus, as well as the ericaceous host, fit the description for *O. ericinum* (Braun, 1987). Inman et al. (2000) suggested that in Europe more than one *Erysiphe* (*Microsphaera*) species produce morphologically similar anamorphs that fit *O. ericinum*. Braun et al. (2003) reported on a collection of *O. ericinum* on *Erica gracilis* in which chasmothecia resembling those of *Erysiphe azaleae* (U. Braun) U. Braun & S. Takam. were formed. Zhao and Shamoun (2006) recently reported an unidentified *Oidium* species on salal (*Gaultheria shallon* Pursh) that resembled the fungus found on *L. axillaris*. *Erysiphe vaccinii* Schwein. and *E. azaleae* also are known to occur on Ericaceae in North America (Braun, 1987) but neither has been reported on *Leucothoë* spp. Earlier reports of powdery mildew on *L. axillaris* were attributed to an unidentified species of *Microsphaera* (*Erysiphe*) in Oregon (Pscheidt and Ocamb, 2005) and North Carolina, (Farr et al., n.d.) and to *Microsphaera penicillata* (possibly *E. azaleae*) in Georgia (Gill, 1979).

In Japan an unidentified species of *Oidium* occurs on *L. axillaris* (Farr et al., n.d.). In the Pacific Northwest, powdery mildew of *Rhododendron* species is widespread and the causal agent generally is regarded as *E. azaleae* (Pscheidt and Ocamb, 2005), suggesting that it might be the fungus found in the present study. However, in Europe multiple species of *Erysiphe* produce anamorphs fitting the description of *O. ericinum* (Inman et al., 2000). A comprehensive taxonomic study, employing molecular as well as morphological data, of Erysiphales on Ericaceae in the Pacific Northwest is needed to clarify which species of *Erysiphe* attacks *Leucothoë* in the region, and to determine the epidemiologic role of possible alternative hosts such as species of *Rhododendron*.

In the outbreak described herein, the disease developed late in the growing season and the discolored leaves rendered the affected plants unmarketable for autumn sale. The retail value of this crop was estimated at \$300,000 - \$450,000. Owing to the potential for development of epidemics resulting in significant cosmetic damage to foliage, this previously unreported disease represents a significant economic threat to production of *L. axillaris*.

Oidium limnanthis Noordel. on *Limnanthes alba* Hartw. ex Benth.

During Winter, 2006, greenhouse grown *Limnanthes alba* plants with a persistent powdery mildew problem were brought to the Oregon State University Plant Clinic for diagnosis. Nearly 700 plants in 1 gallon pots were growing closely together on the greenhouse benches. Foliage of adjacent plants overlapped, air circulation was poor, and plants were watered overhead by hand.

Stems, leaves, and sepals of approximately 25% of the plants were colonized by powdery mildew, leading to premature death. Because the plants were being grown as part of a research project, loss of plants prior to seed set represented a significant problem. The greenhouse was isolated from any field grown *Limnanthes*, and no wild plants of the genus were observed in the proximity of the greenhouse.

The fungus produced hyphae with lobed to irregular appressoria (Fig. 6). Conidiophores produced cylindrical foot cells (Fig. 7) measuring 28-42 (-43.5) x (6.5-) 7-10.5 (-11) μm . Conidia (Fig. 8) were produced singly and were subcylindric to ovoid, lacked fibrosin bodies, measured 32-43.5 (-46) x (11.5-) 12.5-17 (-18) μm , and germinated from a single germ tube produced at the end of the spore (Fig. 9). Several immature chasmothecia were observed with dichotomously branched appendages that were brownish near their bases (Figs. 10, 11); the immature chasmothecia were 85-100 μm and the appendages were 125-130 μm .

Morphological features and host fit the original description of *O. limnanthis* (Noordeloos and Loerakker, 1989). There are no reports of a teleomorph for this fungus. Based on the pseudoidium conidial state and lobed appressoria it is likely that this fungus is an anamorphic *Erysiphe* (Braun et al., 2002; Glawe, 2006). This prediction is borne out by observation in this study of several immature chasmothecia that formed dichotomously branched appendages similar to those characteristic of *Microsphaera* (now regarded as a section of *Erysiphe*). Description of the teleomorph will await discovery of mature chasmothecia. This appears to be the first record of a powdery mildew fungus occurring on a member of the Limnanthaceae in North

America and the first report of *Oidium limnanthis* outside of Europe.

Acknowledgments: PPNS No. 0449, Department of Plant Pathology, College of Agricultural, Human, and Natural Resource Sciences Research Center, Project No. 0313, Washington State University, Pullman, WA 99164-6430, USA. The authors thank Uwe Braun for helpful suggestions and Gary Grove and Jay Pscheidt for reviewing the manuscript.

Literature Cited

- Braun, U. 1987. A monograph of the Erysiphales (powdery mildews). Beih. Nova Hedwigia 89: 1-700.
- Braun, U., R. T. A. Cook, A. J. Inman, and H.-D. Shin. 2002. The taxonomy of powdery mildew fungi. pp. 13-55 in Bélanger, R. R., W. R. Bushnell, A. J. Dik, and T. L. W. Carver, eds. The powdery mildews: a comprehensive treatise. APS Press. St. Paul.
- Braun, U., J. H. Cunnington, U. Brielmaier-Liebetanz, N. Ale-Agha, and V. Heluta. 2003. Miscellaneous notes on some powdery mildew fungi. *Schlechtendalia* 10: 91-95.
- Farr, D. F., A. Y. Rossman, M. E. Palm, and E. B. McCray. (n.d.) Fungal Databases, Systematic Botany & Mycology Laboratory, ARS, USDA. <http://nt.ars-grin.gov/fungal-databases/>
- Glawe, D. A. 2006. Synopsis of genera of Erysiphales (powdery mildew fungi) occurring in the Pacific Northwest. *Pacific Northwest Fungi* 1(12): 1-27. doi: 10.2509/pnwf.2006.001.012
- Gill, D.L. 1979. Powdery mildew and *Cylindrocladium* attack *Leucothoe axillaris*. *Plant Disease Reporter* 63: 358-359.
- Inman, A. J., Cook, R. T. A., and Beales, P. A. 2000. A contribution to the identity of *Rhododendron* powdery mildew in Europe. *Journal of Phytopathology* 148: 17-27.
- Noordeloos, M. E., and W. M. Loerakker. 1989. Studies in plant pathogenic fungi. II. On some powdery mildews (Erysiphales) recently recorded from the Netherlands. *Persoonia* 14: 51-60.
- Pschedit, J. W., and C. M. Ocamb. 2005. Pacific Northwest Plant Disease Management Handbook. Oregon State University. Corvallis.
- Zhao, S., and S. F. Shamoun. 2006. First report of powdery mildew on *Gaultheria shallon* in Canada. *Canadian Journal of Plant Pathology* 28: 313-316.

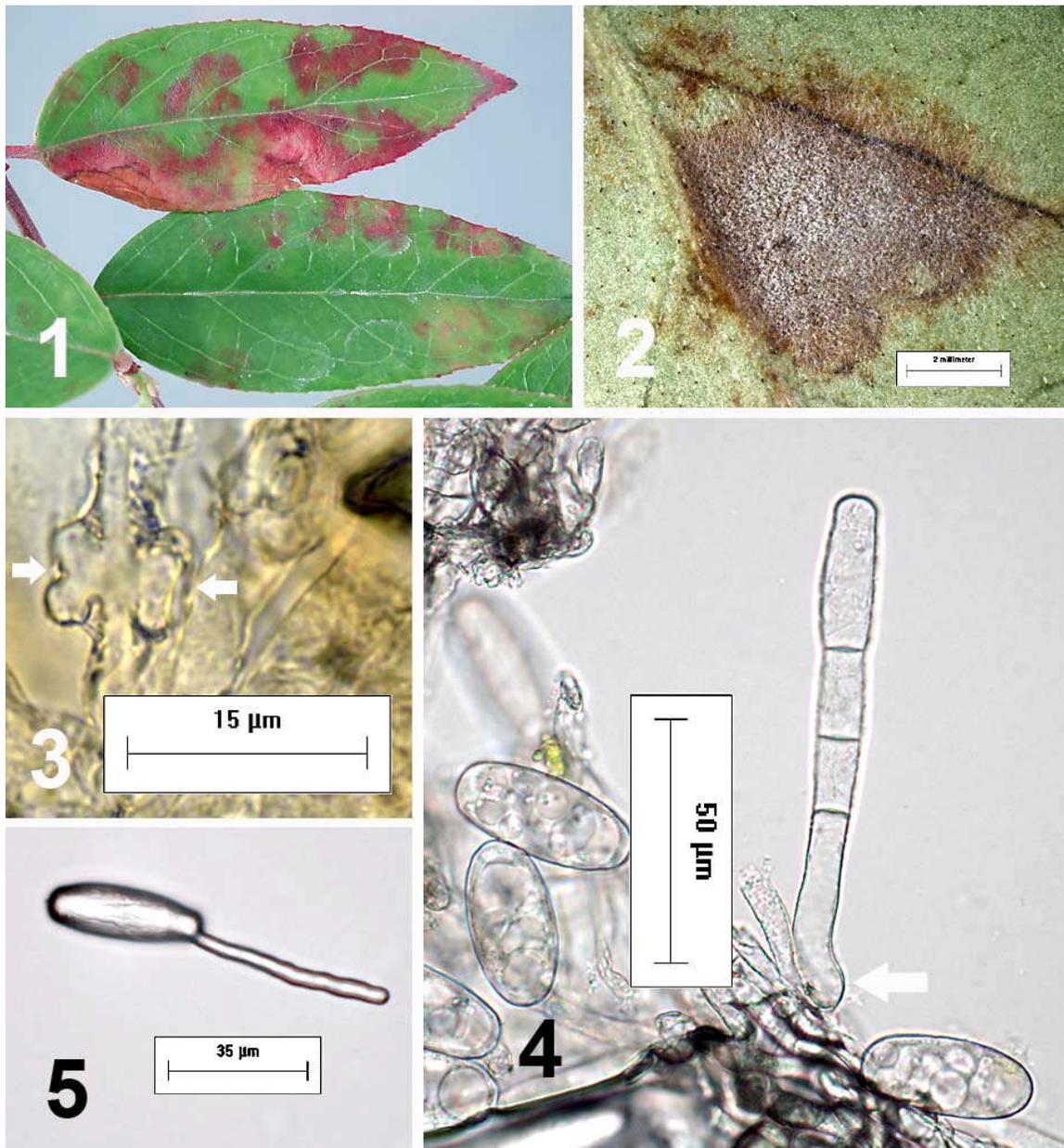


Fig. 1. Symptoms of powdery mildew of *Leucothoë axillaris*. Fig. 2. Lesion on abaxial leaf surface with mycelial growth of *Oidium ericinum*. Scale bar = 2 mm. Fig. 3. Appressoria (arrows) formed by *O. ericinum*. Scale bar = 15 µm. Fig. 4. Conidia and conidiophore of *O. ericinum*; note single immature conidium at apex and characteristically bent base of foot cell (arrow). Scale bar = 50 µm. Fig. 5. *O. ericinum*, germinating conidium with germ tube arising at end of spore. Scale bar = 35 µm.

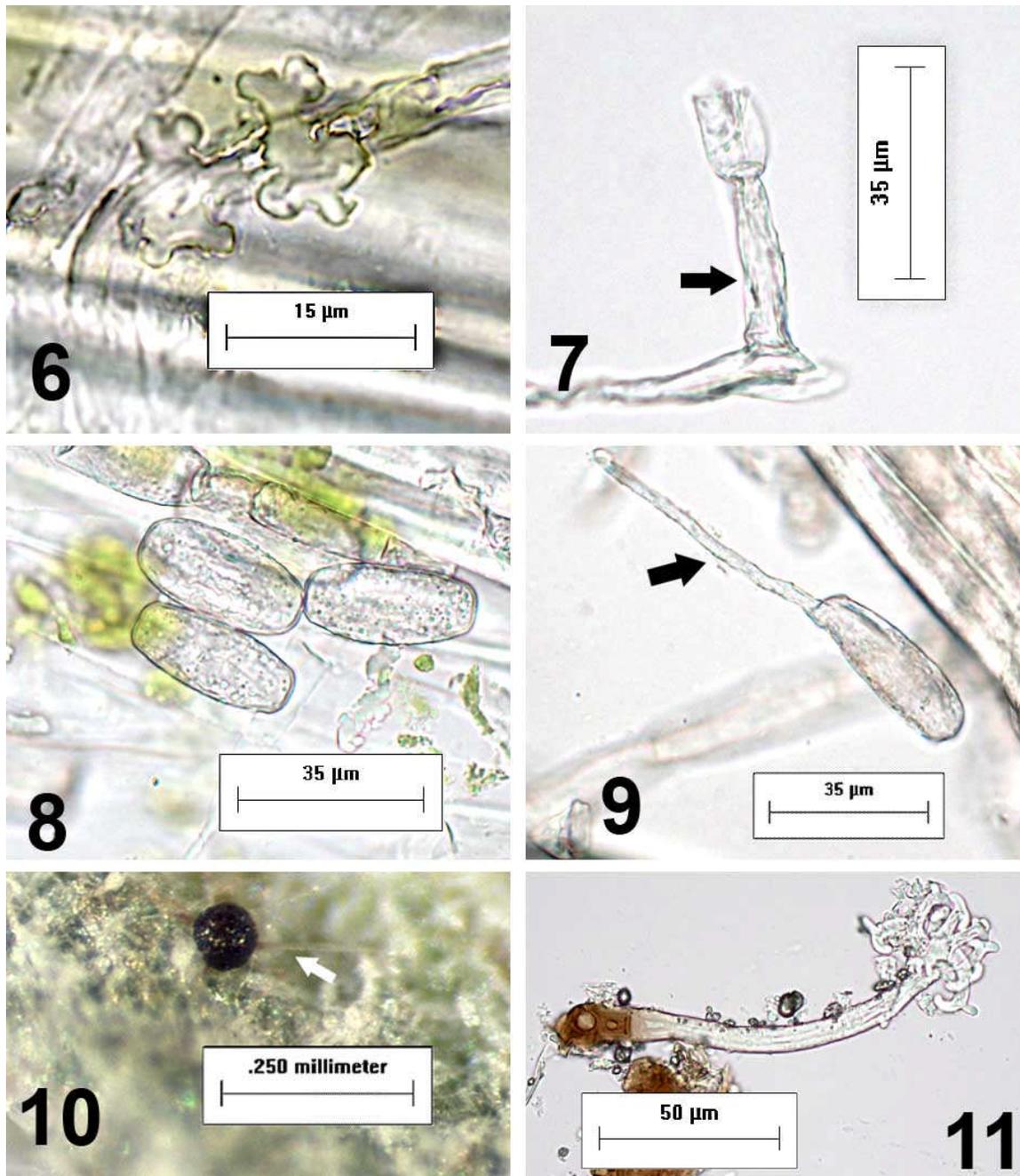


Fig. 6. Appressoria formed by *Oidium limnanthis*. Scale bar = 15 μm . Fig. 7. Foot cell (arrow) formed by *O. limnanthis*. Scale bar = 35 μm . Fig. 8. Conidia formed by *O. limnanthis*. Scale bar = 35 μm . Fig. 9. *O. limnanthis*, germinating conidium with germ tube (arrow) arising at end of spore. Scale bar = 35 μm . Fig. 10. *O. limnanthis*, developing chasmothecium with appendage (arrow). Scale bar = 0.25 mm. Fig. 11. *O. limnanthis*, chasmothecial appendage. Scale bar = 50 μm .