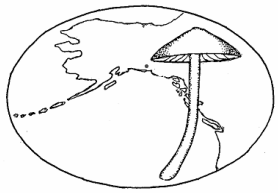
Pacific Northwest Fungi



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Powdery Mildews on Weeds in the Pacific Northwest: A Miscellany of New Records

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Abstract: *Erysiphe polygoni* on *Rumex crispus*, documented previously in California, is reported for the first time in the Pacific Northwest. *Podosphaera* (*Sphaerotheca) fusca* is reported in the Pacific Northwest for the first time on *Taraxacum laevigatum*, a host record documented previously in Europe. New host records for Idaho are *Golovinomyces sordidus* on *Plantago major*, *Erysiphe convolvuli* on *Convolulus arvensus*, and *Podosphaera* (*Sphaerotheca) aphanis* on *Geum macrophyllum*. *Golovinomyces (Erysiphe) cichoracearum* on *Cirsium arvense* is reported for the first time in Washington.

Key words: *Ampelomyces,* biological control, biogeography*, Cirsium arvense*, *Convolulus arvensus*, Erysiphales, *Erysiphye polygoni*, *Eyrsiphe convolvuli*, *Geum macrophyllum*, *Golovinomyces cichoracearum, Golovinomyces sordidus,* plant pathogen, *Plantago major*, *Podosphaera aphanis*, *Podosphaera fusca*, *Rumex crispus*, *Sphaerotheca aphanis*, *Sphaerotheca fusca*, *Taraxacum laevigatum*.

Introduction: Powdery mildews (Erysiphales) on plant species regarded as weeds are of potential practical importance because weeds can function as alternative hosts for powdery mildews attacking crop plants (Clarke and Akhkha 2002) and because some species might have potential for use as biological control agents for those weeds (Kiss 2003; Rector et al. 2006). Publication of host-fungus records for powdery mildews assists mycologists, plant pathologists, weed scientists and others in assessing the biogeography and ecology of hosts and pathogens. Several new host records for powdery mildews on weed species in the Pacific Northwest (PNW) are documented herein, with summary descriptions or references for recent descriptions. When augmentation of published descriptions seemed necessary or useful, we also used photomicrographs to illustrate distinctive characteristics of species that occur on the same host. Because nomenclature of powdery mildews has undergone substantial changes since many earlier reports were published, we summarize nomenclatural aspects of several of the species. Instances in which hosts have been demonstrated to form hybrids with closely related species, thereby introducing potential ambiguity into host-fungus records, are also documented.

Materials and Methods: Observations were made and photographs were taken with an Olympus BH2 research microscope equipped with an Olympus DP11 digital camera, or using a Leica DMR compound microscope equipped with differential interference contrast optics and a Leica MZ95 stereo microscope, both equipped with Leica DC300 digital cameras. Microscopic structures were measured at ca. 200-1000x while mounted in 3% KOH, distilled water or lactic acid. Specimens were deposited with the mycological herbarium in the Department of Plant Pathology, Washington State University, Pullman (WSP) and/or the herbarium of D.A. Glawe as indicated. Details on collectors, dates and location of samples are provided below.

New records for the Pacific Northwest

Erysiphe polygoni DC. on *Rumex crispus* L. (curly dock, Polygonaceae), Glawe 06-617, University of Idaho Arboretum, Moscow, Latah County, Idaho, 15 September 2006. *Erysiphe polygoni* was reported on *R. crispus* in California by Saenz and Taylor (1999) and in various locales in Europe, Asia and South Africa (Farr et al. n.d.). *Erysiphe polygoni* is widespread on numerous hosts in *Rumex* and *Polygonum* (Braun 1987). We also have seen *E. polygoni* repeatedly on *Polygonum aviculare* L. (prostrate knotweed) in Washington and Idaho (Dugan and Glawe, unpublished), and there are numerous prior records in the PNW and elsewhere of this fungus on *P. aviculare* (Farr et al. n.d.). The lectotype of *E. polygoni* also was collected from *P. aviculare* (Braun 1987). Mycelia were amphigenous. Conidia (Fig. 1) were (28-)31-48(-50) x 13-17 µm, lacked fibrosin bodies, and were borne singly (Fig. 2) on conidiophores with foot cells typically (20-)25-50 x 7-8 µm. Appressoria were conspicuously lobed. The observed range of conidial length slightly exceeded that reported in Braun (1987). The teleomorph was not seen on this material.

Podosphaera fusca (Fr.) U. Braun & Shishkoff [*Sphaerotheca fusca* (Fr.) S. Blumer] on *Taraxacum laevigatum* (Willd.) DC. (syn. *T. erythrospermum* Andrz. ex Besser, red-seeded dandelion, Asteraceae), Glawe 06-612, Military Hill, Pullman, Whitman County, Washington, 6 September 2006. *Podosphaera fusca* (as *Sphaerotheca macularis* auct. p.p. or *Sphaerotheca macularis* var. *fuliginea* auct. p.p.) has been reported repeatedly on the closely related *T. officinale* Wigg. (common dandelion) in the PNW and (as these or other species of *Sphaerotheca*) in widespread locations in North America, Europe, and Asia (Farr et al. n.d.). *Taraxacum officinale* and *T. laevigatum* are closely related and can hybridize with each other and other *Taraxacum* spp. (e.g., Richards 1970, Watanabe et al. 1997). The two *Taraxacum*

species generally are morphologically distinct (Hitchcock and Cronquist 1973) but were not distinguished by chloroplast DNA markers (Shibaike et al. 2002). Conidiophores (Fig. 3) had foot cells measuring (44-)49-64.5 x (11-) 11.5-12.5(-13) µm. Hyphae exhibited indistinct to nipple-shaped appressoria (Fig. 4). Conidia (Fig. 5) were doliform, (27.5-)28.5-36.5(-37.5) x (13-) 14-16(-18) µm, and exhibited fibrosin bodies.

New records for Idaho

Golovinomyces sordidus (L. Junell) V.P. Heluta [syns. *Erysiphe sordida* Junell, *E. cichoracearum* auct. pp., *E. lamprocarpa* auct. p.p.] on *Plantago major* L. (broadleaf plantain, Plantaginaceae), Glawe 06-613, University of Idaho Arboretum, Moscow, Latah County, Idaho, 14 September 2006. Conidiophores (Fig. 6) had foot cells measuring (44-)49-64.5 x (11-) 11.5-12.5(-13) µm. Appressoria were lobed (Fig. 7). Conidia (Fig. 8) were borne in chains, doliform, and were (27.5-)28.5-36.5(-37.5) x (13-)14-16(-18) µm. The doliform shape of conidia distinguishes the species from *Phyllactinia guttata* (Wallr.:Fr.) Lév., which also occurs on this host. The absence of fibrosin bodies in conidia and the presence of multiple asci per chasmothecium (Fig. 9) distinguish *G. sordidus* from *Podosphaera* (*Sphaerotheca*) species that were reported on *P. major* from Wisconsin, Europe and Turkey (Farr et al. n.d.). *G. sordidus* occurs on numerous species of *Plantago* (Braun 1987) including *P. major* (usually as *E. cichoracearum*, a name formerly applied more widely than at present) in Montana, Washington and various locations outside the PNW (Farr et al. n.d.).

Erysiphe convolvuli DC. on *Convolulus arvensus* L. (field bindweed, Convolvulaceae), Glawe 06-619, University of Idaho Arboretum, Moscow, Latah County, Idaho, 14 September 2006. *Erysiphe convolvuli* was reported previously on *C. arvensus* from various locations in Washington and Oregon by Glawe et al. (2003), who gave a detailed, illustrated description of the fungus.

Podosphaera aphanis (Wallr.) U. Braun & S. Takam. [*Sphaerotheca aphanis* (Wallr.) U. Braun] on *Geum macrophyllum* Willd. (big-leaf avens, Rosaceae), Glawe 06-621, University of Idaho Arboretum, Moscow, Latah County, Idaho, 14 September 2006. *Podosphaera aphanis* has been reported (as *S. humuli* auct p.p. and *S. macularis* auct. p.p.) on *G. macrophyllum* in Washington (Glawe n.d.). Conidia (Fig. 10) exhibited fibrosin bodies, were oblong elliptical to doliform, typically ca. 25-42 x 14-21 µm and borne in chains, on conidiophores with foot cells typically 50-110 µm long. Appressoria were inconspicuous and papillate. Chasmothecia were not seen on our material. Another powdery mildew documented on *G. macrophyllum* is *E. polygoni*, which produces conidia that lack fibrosin bodies. *Geum macrophyllum* is "weedy" with a strong propensity to powdery mildew in the Seattle area (Jacobson 2001). *Podosphaera aphanis* been reported previously (as *S. macularis* auct. p.p.) on *Geum aleppicum* Jacq. in Washington (Glawe n.d.). *Geum aleppicum* (yellow avens), considered a prevalent weed in Ontario (Alex and Switzer 1976), hybridizes with *G. macrophyllum* but progeny are sterile (Gajewski 1959).

A new host record for Washington

Golovinomyces cichoracearum (DC.) VP Gelyuta [syns. *G. orontii* (Castagne) V.P. Heluta and *Erysiphe cichoracearum* DC.] on *Cirsium arvense* (L.) Scop. (Canada thistle, creeping thistle, Asteraceae), Glawe 06-622, Military Hill, Pullman, Whitman County, Washington, 18 September 2006. *Golovinomyces cichoracearum* was reported (as *Erysiphe cichoracearum*) on *C. arvense* in Alberta, Idaho and Oregon (Chang et al. 2001; Newcombe and Nischwitz 2004). Conidia lack fibrosin bodies, and are borne in chains (Figs. 11, 12). Chasmothecia produce asci with two ascospores per ascus (Fig. 13). Lack of fibrosin bodies and the multiple asci per chasmothecium distinguish *G. cichoracearum* from *Podosphaera* (*Sphaerotheca*) species on this host. Newcombe and Nischwitz (2004)

provided a detailed description. Our material contained an abundance of *Ampelomyces* sp. (Fig. 14), a fungus parasitic on powdery mildews and also noted by Newcombe and Nischwitz (2004). (*Ampelomyces* is usually treated as *A. quisqualis* Ces., but multiple specific epithets have been published; see Ranković 1997). *Golovinomyces cichoracearum* has been listed as a natural enemy of *C. arvense* (Zheng et al. 2004); its effectiveness in attacking *C. arvense* might be diminished by severe infection by *Ampelomyces*. Further research on parasitism of *G. cichoracearum* by *Ampelomyces* species would be useful in clarifying this situation.

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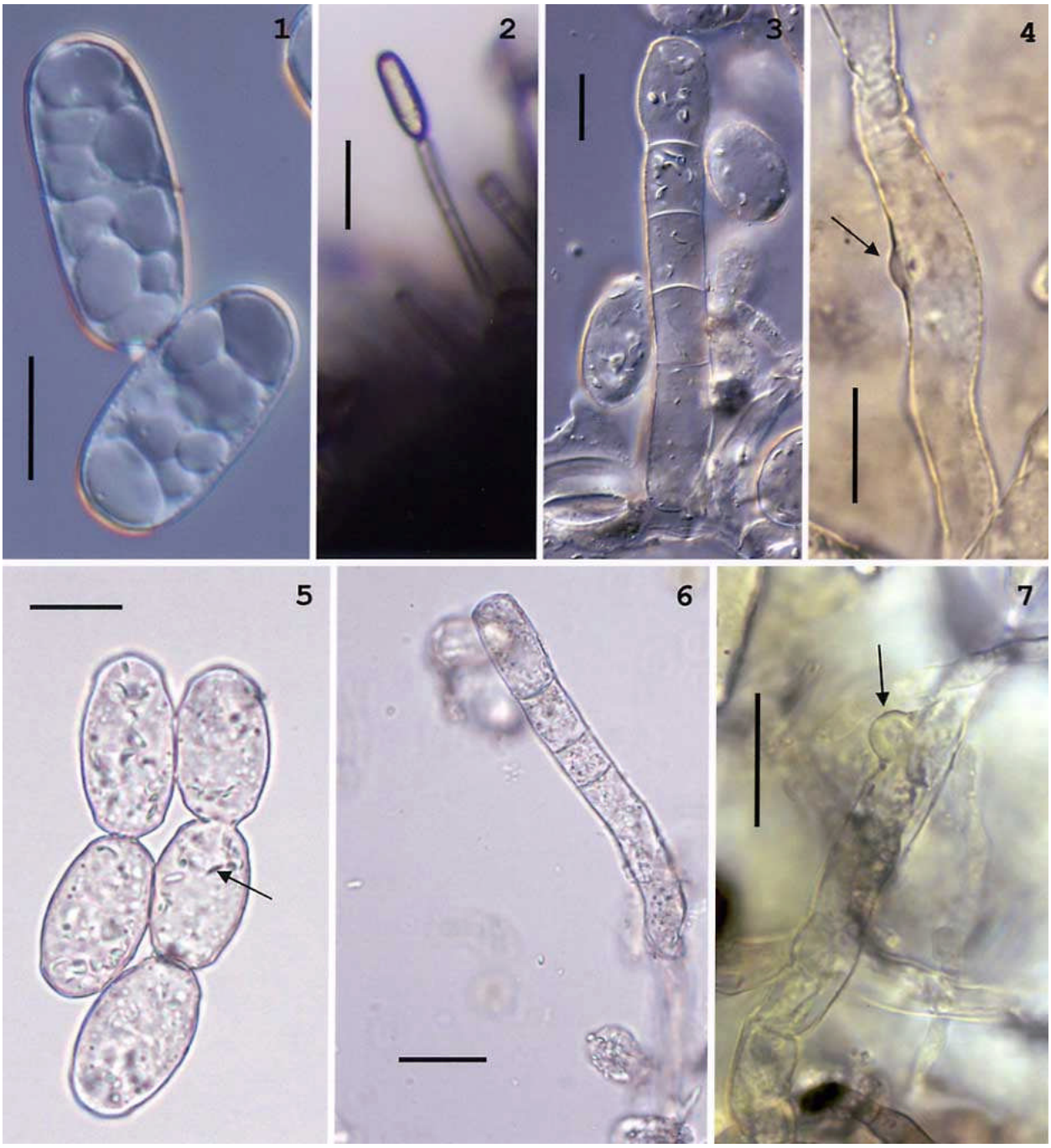
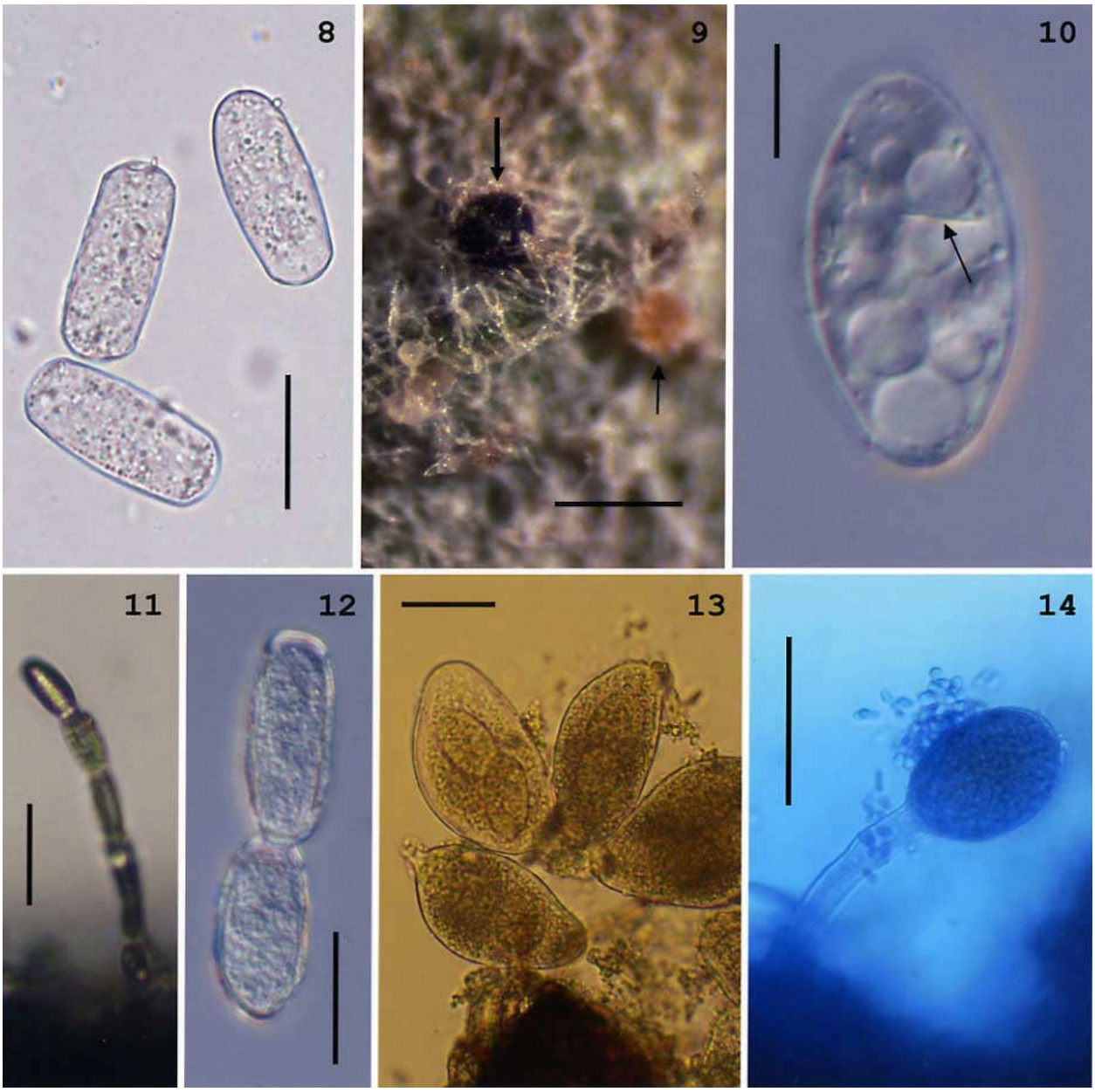


Figs. 1-7. Powdery mildews on weedy plants of the Pacific Northwest. Fig. 1. Conidia of *Erysiphe polygoni*. Bar = 15 µm. Fig. 2. Conidium of *E. polygoni* at apex of conidiophore. Bar = 40 µm. Fig. 3. Conidiophore of *Podosphaera fusca*. Bar = 15 µm. Fig. 4. Appressorium (arrow) of *Podosphaera fusca*. Bar = 10 µm. Fig. 5. Conidia of *Podosphaera fusca* with fibrosin bodies (arrow). Bar = 15 µm. Fig. 6. Conidiophore of *Golovinomyces sordidus*. Bar = 25 µm. Fig. 7. Appressorium (arrow) of *Golovinomyces sordidus*. Bar = 15 µm.



Figs. 8-14. Powdery mildews on weedy plants of the Pacific Northwest. Fig. 8. Conidia of *Golovinomyces sordidus*. Bar = 30 µm. Fig. 9. Chasmothecia of *Golovinomyces sordidus*; wide arrow designates mature (dark) chasmothecium and narrow arrow designates immature (light) chasmothecia. Bar = 0.25 mm. Fig. 10. Fibrosin body (arrow) in conidium of *Podosphaera aphanis*. Bar = 10 µm. Fig. 11. *Golovinomyces cichoracearum* conidiophore and conidia. Bar = 40 µm. Fig. 12. *Golovinomyces cichoracearum* conidia. Bar = 20 µm. Fig. 13. Two-spored asci of *Golovinomyces cichoracearum*. Bar = 30 µm. Fig. 14. Conidioma of *Ampelomyces* sp. on *Golovinomyces cichoracearum*. Bar = 50 µm.