

First Record of the Cyst Nematode *Heterodera filipjevi* on Wheat in Oregon

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Abstract

Plant and soil samples from an irrigated winter wheat (*Triticum aestivum*) field near Imbler (Union County), OR were evaluated for root diseases during April 2007. The field exhibited patches with as much as 90% plant mortality. Previous crops were winter wheat (2004), chickpea (*Cicer arietinum*, 2005), and spring wheat (cv. Jefferson, 2006). Stubble was baled and removed, and the field was cultivated before replanting to winter wheat cv. Chukar in October. Patches of stunted seedlings (three- to five-leaf stage) appeared in March 2007. Stunted seedlings exhibited chlorotic or necrotic lower leaves, healthy younger leaves, few or no tillers, rotting of lower culms and crowns, and light brown roots with little or no branching. Signs and symptoms of fungal pathogens (*Pythium* spp., *Gaeumannomyces graminis* var. *tritici*, *Rhizoctonia solani* AG-8, and *Typhula incarnata*) were present on affected plants. Most small grain fields in Union County are infested with *Heterodera avenae* (4) but none of the roots, on either healthy or stunted plants, exhibited the bushy branching pattern typical of sites where *H. avenae* females penetrate and encyst. Extraction of motile nematodes (Whitehead tray method) from soil revealed high populations of *Pratylenchus neglectus* (6,560/kg of soil), *Tylenchorhynchus* spp. (2,369/kg of soil), and a species initially thought to be *H. avenae* (3,098 juveniles/kg of soil). Cysts were also extracted. During PCR-restriction fragment length polymorphism identification (1) of *H. avenae* collected in Oregon, Washington, and Idaho, four restriction enzymes applied to amplified DNA of cysts from the Imbler field consistently revealed a pattern identical to that of a *H. filipjevi* DNA standard and distinct from patterns of *H. avenae*, *H. schachtii*, and *H. latipons*. DNA standards were obtained from R. Rivoal, INRA, Rennes, France. Morphological evidence confirmed that the specimens were *H. filipjevi*, a member of the '*H. avenae* Group' of cereal cyst nematodes (2,3). Measurements of second-stage juveniles ($n = 15$) included length of body (range = 530 to 570 μm , mean = 549, st. dev. = 13.0), stylet (22.5 to 24.5, 23.2, 0.6) with anchor-shaped basal knobs, tail (52.5 to 62.5, 57.4, 2.7), and hyaline tail terminal (30 to 38, 33.5, 2.6). The lateral field had four lines of which the

inner two were more distinct. Shapes of the tail, tail terminus, and stylet knobs were also consistent with *H. filipjevi*. Cysts ($n = 10$) were lemon shaped and light brown. The cyst wall had a zigzag pattern. The vulval cone was bifenestrate with horseshoe-shaped semifenestra. The cysts were characterized by body length including neck (range = 718 to 940 μm , mean = 809.7, st. dev. = 61.8), body width (395 to 619, 504, 71.2), L/W ratio = (1.1 to 2.2, 1.4, 0.3), neck length (75 to 140, 103.2, 22.1) and width (50 to 95, 71.4, 10.9), fenestra length (50 to 65 μm , 56.5, 6.6) and width (27 to 40, 29.0, 3.8), heavy underbridge (60 to 80, 69, 8.5), vulval slit (7.5 to 8.5, 7.8, 0.4), and many bullae. As described for *H. filipjevi*, cysts hatched much more readily and at lower temperatures than populations of *H. avenae*. Detection of *H. filipjevi* in Oregon represents a new record for the occurrence of this species in the United States and for North America. The pathotype and resistance genes for incorporation into wheat, barley, and oat are being identified.

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