First report of *Coniothyrium minitans*, a mycoparasite of *Sclerotinia sclerotiorum*, in Iran

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Abstract. To study possible biocontrol agents against *Sclerotinia sclerotiorum* on potato plants in Hamadan, Iran, a sampling of sclerotia was conducted in potato fields, and after culturing one of these sclerotia on potato dextrose agar, a coelomycetous fungus was observed. After fulfillment of Koch’s postulates and assessment of morphological characteristics, this fungus was identified as *Coniothyrium minitans*. This is reported for the first time in Iran.

*Sclerotinia sclerotiorum* is an ascomycetous, homothallic and cosmopolitan fungus (Atallah and Johnson 2004), which attacks over 400 species of broad-leaved agricultural and horticultural crops (Boland and Hall 1994), and its resting bodies (sclerotia) can survive for more than 5 years in soil (Gerlagh et al. 1999). This fungus has recently caused stem rot on potato plants (*Solanum tuberosum*) in a large number of fields in Hamadan, a province in the west of Iran (Ojaghian 2009)

To assess possible biological control agents against this pathogen, a sampling of sclerotia was conducted in the main fields of diseased potato in August and September 2007. During culturing some sclerotia were placed onto handmade potato dextrose agar (PDA, infusion of 200 g of potato, 20 g of dextrose, and 15 g of agar for 1 L of medium). The isolate SS4-4 produced a slow-growing and non-aerial mycelium and after 3 weeks, pycnidia developed on the culture medium, mainly around the sclerotium. This abnormal sclerotium had been obtained from the soil of a potato field in Bahar, Hamadan. In order to fulfil Koch’s postulates, a spore suspension of this coelomycetous fungus was prepared by adding 10 mL of sterile distilled water to a 30-day culture grown on PDA, and rubbing the surface of the colony using a sterilised glass spatula. The suspension was filtered through four layers of cheesecloth for removal of mycelial fragments, and the conidial concentration (10⁹ conidia/mL) was determined using a haemocytometer and a compound microscope (Yang et al. 2007). Some surface-sterilised sclerotia were placed on autoclaved sand in a Petri dish, and sprayed with the conidial suspension. To provide adequate humidity for fungal growth, 8 mL of sterile distilled water was added weekly to the Petri dish. This experiment was conducted over five replicates and after 40–45 days, the pycnidia were observed on 70% of sclerotia. After assessment of

Fig. 1. *Coniothyrium minitans* colony on PDA after 10 days.

Fig. 2. *Coniothyrium minitans* colony on PDA after 30 days.
morphological characteristics, this sclerotial mycoparasite was identified as *Coniothyrium minitans* and is reported in Iran for the first time.

Under laboratory condition (25 ± 2°C and natural–fluorescent light) and with 10 replicates on PDA, the colony averaged 3.4 cm in diameter after 10 days. The fungal colony was initially white and without aerial mycelia (Fig. 1) and after 2 weeks, the colour of the colony changed in the centre to grey (Fig. 2).

*Coniothyrium minitans* hyphae are 3–6 µm in diameter, smooth, simple with numerous septa in larger hyphae, and darken and become roughened with age (Phillips 1985; Whipp and Gerlagh 1992). Individual or dual pycnidia are 150–700 µm in diameter, ostiolate, with an even or rough surface, brown to black, subglobose at maturity, usually superficial on sclerotia and sometimes immersed, and become very dark with age (Fig. 3). Pycnidiospores are dark brown in mass, ovoid to ellipsoid or shortly cylindrical or nearly globose (Fig. 4), smooth to roughened and 4–7 × 2.5–4 µm (Punithalingam 1982).

*Coniothyrium minitans* was first described for biological control of *Sclerotinia sclerotiorum* in California (Campbell 1947) and has been usually isolated from sclerotia in soil from more than 30 countries on all continents except Antarctica (Sandys-Winsch et al. 1993). This fungus is an ecologically fastidious mycoparasite (Whipps et al. 2008) on sclerotia of many ascomycetous fungi such as *Sclerotinia sclerotiorum*, *S. minor*, *S. trifoliorum*, *Botrytis* spp. and some strains of *Sclerotium cepivorum*, but it is not able to parasitise the sclerotia of *Clborinia camellia* (Van Toor et al. 2005) and basidiomycetous sclerotia (Whipp and Gerlagh 1992). There are several phenotypes of this fungus that differ in colony morphology and other biological characteristics, but the most important feature is the ability to parasitise sclerotia of *S. sclerotiorum* (Whipps et al. 2008).

*Coniothyrium minitans* has displayed a good ability to infect and degrade sclerotia in soil and has a potential to control *S. sclerotiorum* by decreasing carpogenic germination and viability of sclerotia (Whipp and Budge 1990; Jones and Whipp 2002). This fungus was systematically classified in the order of Pleosporales and was reclassified as *Paraconiothyrium minitans*, based on anamorphic characteristics, maximum parsimony analysis of ITS and SSU nrDNA sequences (Verkley et al. 2004) but due to common usage, *Coniothyrium minitans* continues to be used in current articles. Because of variable biocontrol efficacy of isolates on different sclerotium-forming pathogens (Gerlagh et al. 1996), it is necessary to search for more efficient isolates.

**References**


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