Diseases Caused by Oomycetes

First Report of White Rust of Spinach Caused by *Albugo occidentalis* in Italy

G. Gilardi,¹ G. Tabone,¹ V. Guarnaccia,^{1,2} and M. L. Gullino,^{1,†}

¹Centre of Competence for Innovation in the Agro-Environmental Sector (AGROINNOVA), University of Torino, 10095 Grugliasco, Italy

²DISAFA, University of Torino, 10095 Grugliasco, Italy

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Spinach (*Spinacia oleracea*) is cultivated for the ready-to-eat sector in the Lazio region (Central Italy) in the field (650 ha) and under multitunnels (150 ha). Signs and symptoms of white rust was first observed on cv. Platypus in November 2020 and increased through February 2021, when 40 to 60% of plants in the field and 20 to 50% of those cultivated under 6 ha in multitunnels were affected. Symptoms consisted of circular yellow chlorotic spots on the upper leaf surface, with creamy to white 1 to 4 mm diameter blister-like pustules prevalent on the underside of the leaf, and occasionally observed on the upper leaf surface as irregularly elongated rings. Microscopic examination of sporangia from the affected leaf tissues were globose to ovoid, with smooth-walled surfaces, and measured 12.5 to 19.2 × 13.2 to 24.0 (16.2 × 19.1 average, $n = 50$) µm. Oospores were never observed from the symptomatic leaf tissues. DNA was extracted from symptomatic leaf tissue with the Fungal DNA Mini Kit (Omega BioTek, Norcross, GA), according to the manufacturer's instructions. The internal transcribed spacer (ITS) regions of rDNA were amplified using the primers ITS1/ITS4 (White et al. 1990) (GenBank accession no. MW751991). BLAST analysis (Altschul et al. 1997) of the 673-bp segment

showed a 100% similarity with *Albugo occidentalis* (GenBank accession no. AJ553900). To confirm pathogenicity, 30-day-old spinach plants cv. Platypus grown in 2-liter pots (10 plants/pot) were sprayed with 10 ml of sporangial suspension (1×10^5 sporangia/ml), covered with polyethylene bags for 7 days, and maintained in a greenhouse at 18 to 20°C and 85 to 90% relative humidity. Control noninoculated plants were sprayed with distilled water and held under the same environmental conditions. There were five pots of inoculated plants and five pots of noninoculated controls plants. Yellow spots similar to those observed on affected field plants developed 11 to 13 days after the inoculation, with typical blister-like pustules appearing 4 days later on the underside of the leaves. All the noninoculated plants were asymptomatic. The pathogenicity test was conducted twice, giving the same results. White rust is an economically important disease of spinach reported in United States, China, Iran, and Canada (Farr and Rossman 2021). It is constantly expanding to new areas, and it was recently observed in Greece (Vakalounakis and Doulis 2013), Mexico (Correll et al. 2017), and Turkey (Soylu et al. 2018). This is, to our knowledge, the first report of *A. occidentalis* on spinach in Italy. According to the regional agricultural extension service, the disease was sporadically observed in the same production fields in 2018. The presence of this pathogen is of concern since management relies on the use of fungicides, and little information is available on resistant cultivars appreciated by the ready-to-eat market.

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[†]Indicates the corresponding author.
M. L. Gullino; marialodovica.gullino@unito.it