Diseases Caused by Fungi and Fungus-Like Organisms

First Report of *Puccinia menthae* Causing Leaf Rust on Spearmint (*Mentha spicata*) in Mexico

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Spearmint (Lamiaceae) is an aromatic herb widely cultivated in Mexico for its culinary, medicinal, and industrial properties. In May 2020, symptoms and signs of rust were observed in a 2-ha commercial crop of spearmint in Cuautla, Morelos (18°50'26.6"N 98°57'31.9"W), Mexico. The disease incidence was 85% and the severity was 23%. Initial symptoms included chlorotic spots on the adaxial surface of the leaves. At advanced stages of the disease, necrotic spots surrounded by chlorotic halos developed, and later the plants were defoliated. The signs were observed as numerous orange to reddish-brown erumpent pustules primarily on the abaxial surface of the leaves. Microscopic examination of the samples revealed the presence of subepidermal uredinia, erumpent, with hyaline and cylindrical paraphyses. Urediniospores ($n = 50$) were hyaline to light yellow, globose to obovoid, measuring 17 to 27×11 to $25 \mu\text{m}$, including 0.6 to $0.7 \mu\text{m}$ wall thickness, individually supported on pedicels, echinulate, with two germinative pores. Morphological features of the fungus correspond with previous descriptions of *Puccinia menthae* by Kabaketepe et al. (2017). A voucher specimen (accession no. UACH448) was deposited in the Department of Agricultural Parasitology Herbarium at the Chapingo

Autonomous University. To confirm identification, the 28S gene region of rDNA was amplified from one sample by a nested PCR using the primer sets Rust2inv (Aime 2006) and LR6 (Vilgalys and Hester 1990), and Rust28SF primers (Aime et al. 2018) and LR5 (Vilgalys and Hester 1990) for the first and second reactions, respectively. The sequence of our specimen (GenBank accession no. OL878354) showed 100% homology (923/1304 bp) with the type-specimen sequence of *P. menthae* (GenBank accession no. DQ354513) from *Cunila origanoides* from the United States (Aime 2006). Also, a phylogenetic analysis (Bayesian inference) including a published 28S dataset for *Puccinia* species was performed and the isolate UACH448 was grouped into a clade with *P. menthae*. Pathogenicity was demonstrated by spraying 5 ml of a suspension of urediniospores (1×10^4 spores/ml) recovered from infected leaves onto leaves of 10 healthy spearmint plants, and 10 noninoculated plants served as controls. All plants were maintained at temperatures from 28 to 35°C and relative humidity ranging from 70 to 80%. All inoculated plants developed the characteristic symptoms of the disease after 14 days, whereas the control plants remained symptomless. The pathogenicity test was performed twice with similar disease response. The morphological characteristics of the pathogen recovered from all the inoculated plants were identical to that originally inoculated, thus fulfilling Koch's postulates. To our knowledge, this is the first report of *Puccinia menthae* causing leaf rust on *Mentha spicata* in Mexico. This species has been previously identified in Australia (Edwards et al. 1999), New Zealand (Beresford 1982), and the United States (Farr and Rossman 2021) on *Mentha spicata*. This disease reduces considerably the quality of peppermint plants, so it is necessary to develop management strategies.

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