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NOTE

Powdery mildew of oak (*Quercus robur*) caused by *Erysiphe alphitoides* in the Northwest of Argentina

Oídio del roble (*Quercus robur*) causado por *Erysiphe alphitoides* en el Noroeste de Argentina

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Abstract

The common oak, although infrequently, can be found as urban trees in the cities of northwestern Argentina. Between late 2023 and early 2024, leaves of *Quercus robur* exhibiting typical symptoms of powdery mildew were collected from three provinces in this region. Based on its morphological characteristics, host specificity, and the available descriptions, the fungus was identified as *Erysiphe alphitoides* in the asexual phase. This represents the first report of this fungus in northwestern Argentina. The symptoms of the disease, as well as the morphological characteristics of the anamorph are described and illustrated.

Keywords: Anamorph; biological control; Erysiphaceae; *Erysiphe*; hyperparasite; *Quercus*.

Resumen

El roble común está presente, aunque de forma infrecuente, en el arbolado urbano de las ciudades del noroeste argentino. Entre finales del 2023 y principios del 2024 se colectaron hojas de *Quercus robur* que presentaban los síntomas típicos de un oídio en tres provincias de esta

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región. El hongo se identificó en función de sus características morfológicas, su hospedador y consultando descripciones disponibles como la fase asexual de *Erysiphe alphitoides*. Este es el primer reporte de este hongo para el noroeste argentino. Se describen e ilustran los síntomas de la enfermedad y las características morfológicas del anamorfo.

Palabras clave: Anamorfo; control biológico; Erysiphaceae; *Erysiphe*; Roble.

INTRODUCTION

Quercus robur L. (Fagaceae), known as the “common oak” or “European oak”, is a tree native to the northern hemisphere, specifically Europe and Western Asia. It has been introduced to various regions around the world, including Argentina, where is occasionally found in urban areas as an ornamental species. In late 2023, typical symptoms of powdery mildew were observed on the foliage of *Q. robur* specimens in different locations within the province of Tucumán, Argentina. In these infected specimens, whitish, powdery spots were noted on both the abaxial and adaxial surfaces. Following this discovery, similar symptoms were also observed in oak specimens from the neighboring provinces of Catamarca and Santiago del Estero.

Based on the observed morphological characteristics and the host plant, the infection was identified as being caused by the anamorph of *Erysiphe alphitoides* (Griffon & Maubl.) U. Braun & S. Takam. This powdery mildew species is known to cause significant foliar diseases in oaks, including *Q. robur* (Takamatsu *et al.*, 2007). Originally described in France under the name *Microsphaera alphitoides* (Griffon & Maublanc, 1912), it is well-documented and widely spread across Europe (Bradshaw *et al.*, 2022; Takamatsu *et al.*, 2007). In Argentina, however, it was only recorded in Buenos Aires (Marchionatto, 1944; Braun *et al.*, 2000) and Río Negro (Havrylenko, 1995; Takamatsu *et al.*, 2007).

This is the first report of *E. alphitoides* causing powdery mildew on oak trees in northwestern Argentina (Tucumán, Catamarca, and Santiago del Estero). The symptoms of the disease and the morphological characteristics of the anamorph are described and illustrated herein.

MATERIALS AND METHODS

Over 250 leaves from adult *Quercus robur* individuals were collected from various public spaces across Tucumán Province. Additionally, samples were gathered from infected plant communities in Catamarca and Santiago del Estero.

The collected leaves were first examined with a magnifying glass to identify symptoms of powdery mildew. Subsequently, fungal samples were extracted from the infected leaves and placed in water for further examination under the optical microscope. At least 30 measurements of conidiophores, pycnidia, and conidia were recorded. Reference specimens are housed in the fungal collection at Fundación Miguel Lillo (LIL).

RESULTS

Erysiphe alphitoides (Griff. & Maubl.) U. Braun & S. Takam.,
Schlechtendalia 4: 5, 2000.
≡ *Microsphaera alphitoides* Griff. & Maubl.,
Bull. Soc. Mycol. France 28: 103, 1912. (Fig. 1, 2)

Symptoms.— Colonies of powdery mildew were observed on both the abaxial and adaxial surfaces of leaves, with predominance on the upper surface. The infection appeared in either an effuse or patchy manner. The frequency and severity of infection by *E. alphitoides* varied with the age of the leaf. Infections were more pronounced on shoots, branches, and new leaves. Younger leaves exhibited symptoms such as malformations and curling of leaf edges. However, infected trees did not show signs of defoliation. Older, fully developed leaves displayed only minimal symptoms of powdery mildew (Fig. 1).

Microscopic Characteristics.— Mycelium amphigenous, mainly epiphyllous, in white patches or effuse, persistent on the upper leaf surface. Hyphae branched, septate, hyaline, thin-walled, smooth or almost so. Appressoria lobed, solitary or in opposite pairs. Anamorph abundant. Conidiophores arising terminally from the mother cell, mostly central, erect, straight, rarely curved or flexuous, $31.25\text{--}50(-75) \mu\text{m}$, on the lower leaf surface often longer, foot-cells cylindrical, $18.75\text{--}31.25 \mu\text{m}$, followed by 1–3 shorter cells. Conidia solitary, primary conidia obovoid-ellipsoid, apex rounded, base subtruncate $28.75\text{--}37.5(-40) \times 12.5\text{--}13.75 \mu\text{m}$, secondary conidia doliiform when mature $31.25\text{--}37.5(-40) \times 16.25\text{--}18.75 \mu\text{m}$, ends truncate or subtruncate, immature ones sometimes ellipsoid-cylindrical, germ tubes terminal to subterminal, short to moderately long, usually terminating with a lobed appressorium (Fig. 2).

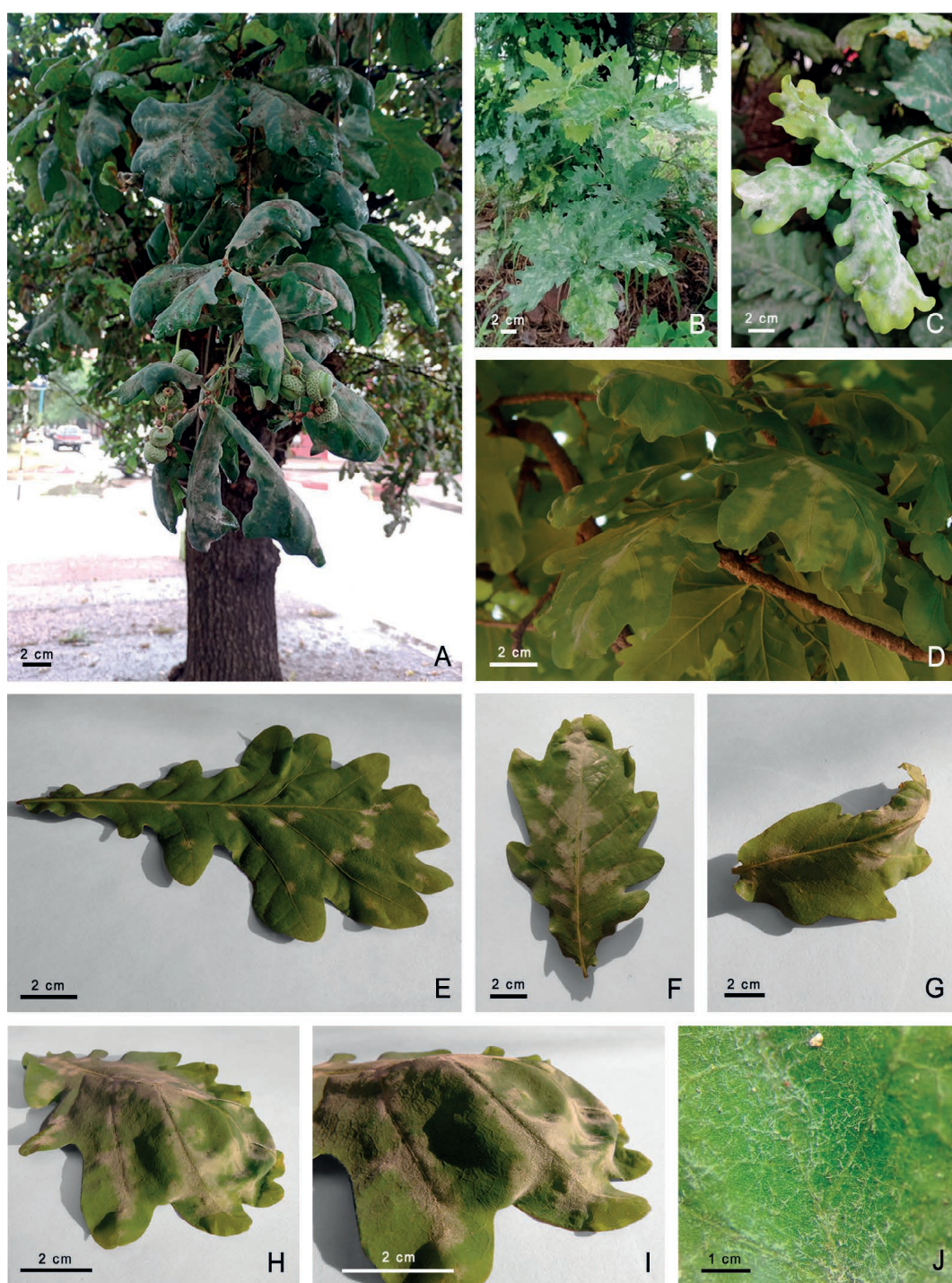


Fig. 1. *Quercus robur* parasited by *Erysiphe alphitoides* (samples from Tucumán). A-D) Symptomatic leaves on trees. E-J) Symptomatic leaves.

Fig. 1. *Quercus robur* parasited by *Erysiphe alphitoides* (muestras de Tucumán). A-D) Hojas sintomáticas sobre los árboles. E-J) Hojas sintomáticas.

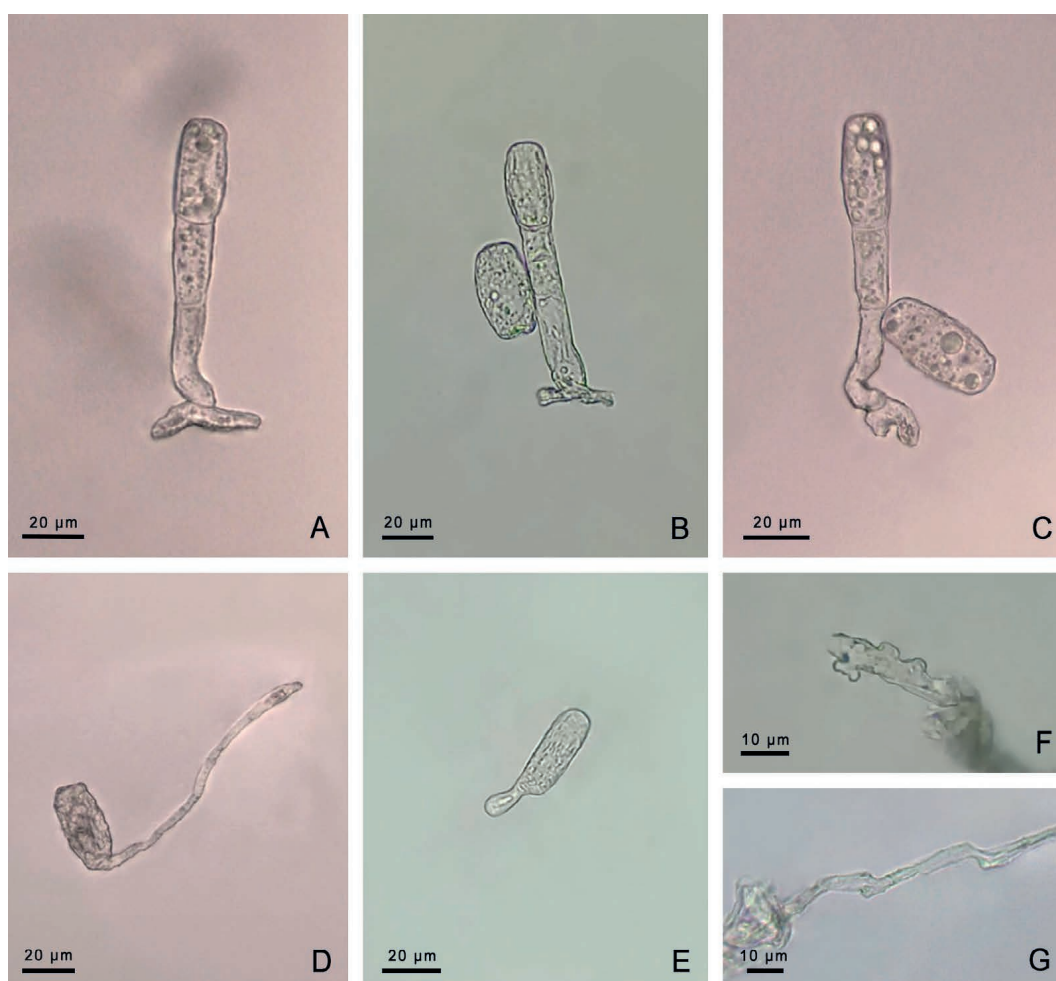


Fig. 2. *Erysiphe alphitoides*. A) Conidiophore with primary conidia. B, C) Conidiophores with primary conidia and secondary conidia free. D, E) Conidia with germ tubes. F, G) Appressoria.

Fig. 2. *Erysiphe alphitoides*. A) Conidióforo con conidio primario. B, C) Conidióforos con conidio primario y conidio secundario libre. D, E) Conidios con tubo de germinación. F, G) Apresorios.

Comments.— Under the optical microscope, *Ampelomyces* sp. (Phaeosphaeriaceae) was observed in close association with the mycelium of *Erysiphe alphitoides* (Fig. 3). *Ampelomyces* is a common intracellular mycoparasite of powdery mildew, and it was found affecting the hyphae, conidiophores, and conidia of *E. alphitoides*. This hyperparasite is of both ecological and economic significance. It has recently been reported in the province, where it was observed parasitizing specimens of *Erysiphe platani* (Castillo & Suárez, 2023).

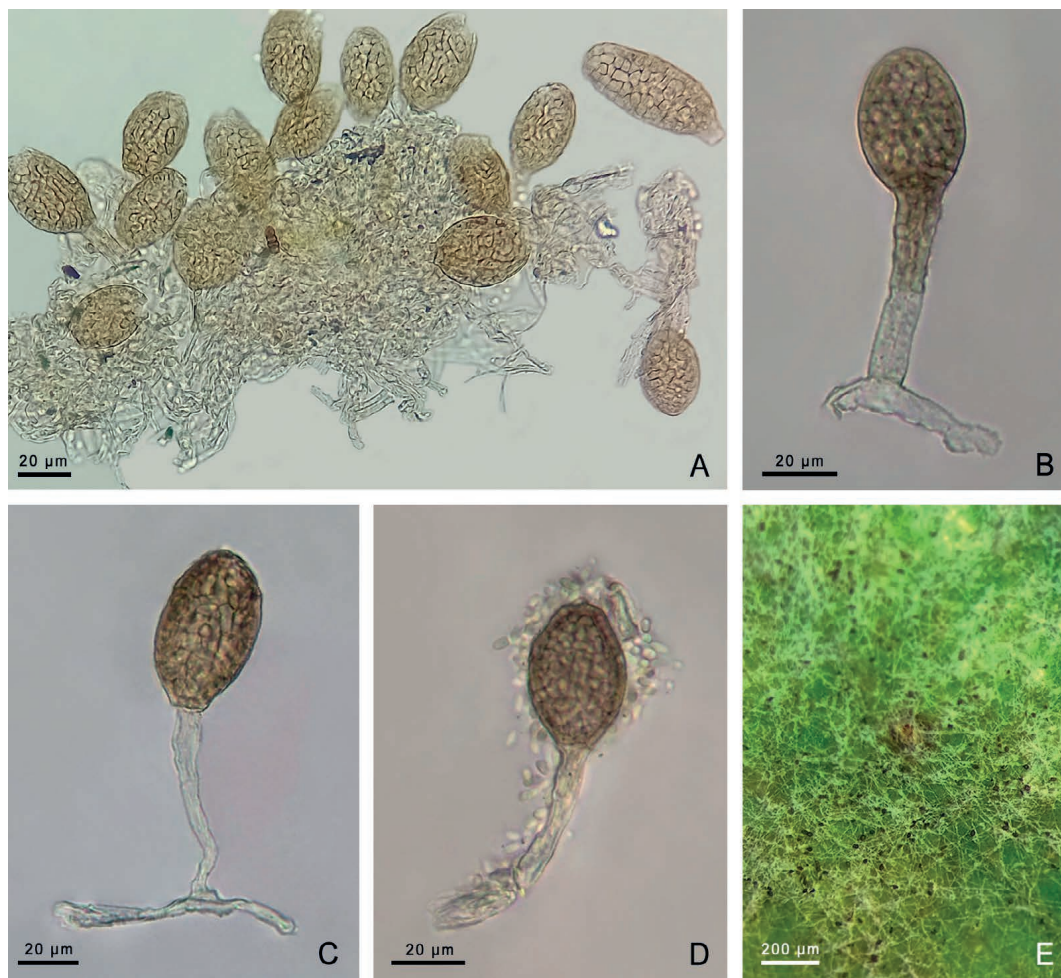


Fig. 3. Pycnidia of *Ampelomyces* sp. A) General view of numerous pycnidia. B, C) pycnidia. D) Pycnidium globose liberating conidia. E) General view of numerous pycnidia hyperparasitizing *Quercus robur*.

Fig. 3. Pycnidios de *Ampelomyces* sp. A) Vista general de numerosos picnidios. B, C) Picnidios. D) Picnidio globoso liberando conidios. E) Vista general de numerosos picnidios hiperparasitando *Quercus robur*.

In *Erysiphe alphetoides* the infection by *Ampelomyces* sp. occurred on colonies of the powdery mildew that developed on leaves of *Quercus robur*. The detected hyperparasite was observed inside the powdery mildew hyphae causing alterations and deformation. Pycnidia were dark brown to light brown colored, showed diverse morphology (globose, elongated or fusiform) with variable size, according to each shape. When spherical they measured $31.25\text{--}43.75\text{ }(-56.25) \times (-15)\text{ }18.75\text{--}27.5\text{ }(-31.25)\text{ }\mu\text{m}$, and the elongated to fusiform $(-60)\text{ }65\text{--}100 \times 22.5\text{--}27.5\text{ }(-31.25)\text{ }\mu\text{m}$. The pycnidia produced abundant ellipsoid to oblong hyaline conidia $6.25\text{ }(-7.50) \times 2.50\text{ }(-3.75)\text{ }\mu\text{m}$.

Selected Specimens examined (all on *Quercus robur* infected with *Erysiphe alphetoides*).— ARGENTINA. Catamarca, Dpto. San Fernando del Valle de Catamarca (av. Belgrano 462), $28^{\circ}27'37.8''\text{S } 65^{\circ}46'51.9''\text{W}$, 527 m snm, 20-IX-2023, L. Castillo & M. Ibris 2009 (LIL 161000); Dpto. El Alto, Guayamba (frente a la capilla), $28^{\circ}20'39.7''\text{S } 65^{\circ}23'53.3''\text{W}$, 1,066 m snm, 12-III-2024, F. Moreno s/n (LIL 161002); (calle a Las Ollas), $28^{\circ}20'39''\text{S } 65^{\circ}23'49''\text{W}$, 1,066 m snm, 12-III-2024, F. Moreno s/n (LIL 161001); $28^{\circ}20'42''\text{S } 65^{\circ}23'48''\text{W}$, 1,064 m snm, 12-III-2024, F. Moreno s/n (LIL 161003). Santiago del Estero, Dpto. Capital, Ciudad de Santiago del Estero, Barrio Juramento (calle Vinará y Av. Moreno), $27^{\circ}48'56.1''\text{S } 64^{\circ}14'59.6''\text{W}$, 184 m snm, 21-III-2024, Roger s/n (LIL 161004). Tucumán, Dpto. San Miguel de Tucumán (calle Carlos Pellegrini 70), $26^{\circ}49'38.5''\text{S } 65^{\circ}13'35.4''\text{W}$, 446 m snm, 23-X-2024, G. Suárez & M. Ibris 2010 (LIL 161005); (calle Estados Unidos 110), $26^{\circ}49'22.2''\text{S } 65^{\circ}11'35.1''\text{W}$, 434 m snm, 23-VIII-2023, L. Castillo 2012 (LIL 161006); (Plaza San Martín), $26^{\circ}50'19''\text{S } 65^{\circ}12'39.8''\text{W}$, 430 m snm, 26-VIII-2023, L. Castillo 2011 (LIL 161007); (calle Juan Crisóstomo Álvarez), $26^{\circ}49'46''\text{S } 65^{\circ}13'06''\text{W}$, 438 m snm, 26-X-2023, M. Ibris 2047 (LIL 161008); Dpto. Tafí del Valle, Tafí del Valle (av. Presidente Juan D. Perón), $26^{\circ}51'12''\text{S } 65^{\circ}42'31.5''\text{W}$, 1,992 m snm, 09-XII-2023, M. Ibris 2008 (LIL 161009); Dpto. Trancas, San Pedro de Colalao (calle Salta), $26^{\circ}14'09''\text{S } 65^{\circ}29'53''\text{W}$, 1,075 m snm, 26-IV-2024, G. Suárez 2045 (LIL 161010); Dpto. Yerba Buena, Villa Carmela (calle Leopoldo Lugones y Calle Los Pinos), $26^{\circ}46'11.7''\text{S } 65^{\circ}16'28.3''\text{W}$, 562 m snm, 28-II-2024, M. Ibris 2004, 2005, 2006 (LIL 161011, LIL 161021, LIL 161012); (Barrio 240 viviendas), $26^{\circ}46'18.5''\text{S } 65^{\circ}16'58.5''\text{W}$, 571 m snm, 28-II-2024, M. Ibris 2007 (LIL 161013); (calle Saavedra Lamas), $26^{\circ}48'03''\text{S } 65^{\circ}18'28.8''\text{W}$, 542 m snm, 01-III-2024, M. Ibris 2015, 2016, 2017, 2018 (LIL 161014, LIL 161015, LIL 161016, LIL 161017).

CONCLUSIONS

In Northwestern Argentina, examined *Quercus robur* trees with symptoms of powdery mildew showed severe infections caused by *E. alphitoides*. Younger leaves displayed more pronounced disease symptoms compared to older leaves, including curling and malformations, which adversely affected their ornamental quality. While infections by this powdery mildew have been previously documented in trees from various locations in Buenos Aires and Rio Negro (Takamatsu *et al.*, 2007), this study represents the first record of *E. alphitoides* in the region (Tucumán, Catamarca, and Santiago del Estero). Additionally, *E. alphitoides* was found to be intensely parasitized by *Ampelomyces* sp.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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