



Natural occurrence of the mycoparasite *Ampelomyces quisqualis* (Ascomycota, Phaeosphaeriaceae) in urban environments from Tucumán (Argentina)

Ocurrencia natural del hiperparásito *Ampelomyces quisqualis* (Ascomycota, Phaeosphaeriaceae) en ambientes urbanos de Tucumán (Argentina)

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ABSTRACT

Platanus × acerifolia is used as an urban shade tree in many cities throughout Argentina. In late autumn and winter of 2023, leaves and fruits of *P. × acerifolia* showing typical symptoms of a powdery mildew were collected along the main streets of Tucumán, Argentina. Its morphology and comparison with published descriptions allowed us to identify the fungus as the asexual morph of *Erysiphe platani*. The specimens were heavily hyperparasitized by *Ampelomyces quisqualis*, a mycoparasitic ascomycete, used as a natural biological control of the development of powdery mildew species. This work reports the natural occurrence of *Ampelomyces* in urban environments in Argentina. The disease symptoms and morphological characteristics of the powdery mildew anamorph and the mycoparasite are described and illustrated.

Keywords — Argentina Northwest (NOA); anamorph; biological control; Erysiphaceae; *Erysiphe*; hyperparasite; *Platanus*.

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RESUMEN

Platanus × acerifolia es usado como un árbol urbano de sombra a lo largo de Argentina. A finales del otoño e invierno del 2023, las hojas y frutos de *P. × acerifolia* que mostraban los típicos síntomas de un mildiú pulverulento, se recolectaron en las principales calles de Tucumán, Argentina. Basados en su morfología y comparando con descripciones disponibles, el hongo fue identificado como la forma asexual de *Erysiphe platani*. Los especímenes estaban fuertemente hiperparasitados por *Ampelomyces quisqualis*, un ascomicete micoparásito usado como controlador biológico natural del desarrollo de especies de mildiú pulverulento. Este trabajo reporta la ocurrencia natural de *Ampelomyces* en ambientes urbanos de Argentina. Se describen e ilustran los síntomas de la enfermedad y las características morfológicas del anamorfo y el micoparásito.

Palabras clave — Anamorfo; control biológico; Erysiphaceae; *Erysiphe*; hiperparásito; Noroeste de Argentina (NOA); *Platanus*.

INTRODUCTION

Platanus × acerifolia (Aiton) Willd., known locally as “plátano”, is an ornamental tree in urban areas, frequently planted in parks and along traffic routes in Argentina. During 2023, the presence of a disease affecting the foliage and fruits of *P. × acerifolia* (= *P. × hispanica* Münchh.) was observed in recreational places, streets, and other urban and rural areas in Tucumán (Argentina).

In the affected leaves, the presence of whitish-gray spots of powdery dusty appearance was perceived. Based on the morphology of the asexual stages, as well as on the identity of the host plant species (Braun & Cook, 2012; Kirschner, 2011; Pastirčáková & Pastirčák, 2006, 2008), the causal agent of this powdery mildew infection was identified as *Erysiphe platani* (Howe) U. Braun & S. Takam. It is a powdery mildew species native to North America, where is known to occur on *Platanus* spp., and has been introduced in South America, South Africa, Australia, New Zealand, Asia, and several European countries as well (Heluta *et al.*, 2013). This is the first record of *E. platani* in Argentina Northwest (“Noroeste Argentino”; hereafter NOA). So far, it has only been reported from Mendoza (Klingner, 1982) and Buenos Aires (Braun *et al.*, 2000).

However, another fungus associated with the mycelium of *E. platani*, causing dark gray colors and a dirty appearance, particularly towards the edge of the lesions, was detected. When these lesions were observed under a light microscope, abundant globose to pyriform fructifications were found affecting the hyphae, basal cells of conidiophores, and conidia of *E. platani*, causing alterations and deformation. The organism was identified as *Ampelomyces quisqualis* Ces. (Phaeosphaeriaceae), an ecologically and economically important hyperparasite that is widely distributed throughout the world (Kiss, 2008).

In this paper, we also report the presence of *Ampelomyces quisqualis*, a mycoparasite affecting powdery mildews in urban environments in Argentina. The symptoms

caused by fungus on the infected plants and the microscopic characters of both parasites are described and illustrated.

MATERIALS AND METHODS

Specimens and morphology

Leaves and fruits of *P. × acerifolia* (adult individuals) were collected in Tucumán (NOA) in public spaces such as parks, pedestrian areas and so forth. Besides, other sample sites with infected plant communities from Buenos Aires, San Juan, and Santa Fe were included in this work.

Over 200 leaves and 40 fruits were examined under a magnifying glass for the presence of powdery mildew symptoms and studied under a light microscope. Fungal samples were taken from leaves and fruit and mounted in water for study with a light microscope. At least 30 values of conidiophores, pycnidia, and conidia were measured. Reference specimens were deposited at the fungal collection of Fundación Miguel Lillo (LIL).

RESULTS

Erysiphe platani (Howe) U. Braun and S. Takam.,
Schlechtendalia 4: 12, 2000. Bas.: *Microsphaera platani* Howe, Bull.
Torrey Bot. Club 5: 4, 1874.

Symptoms.— White powdery mildew colonies were apparent primarily on the upper leaves surface. Different frequencies and infection degrees by *E. platani*, depending on the leaf age, were noted. The infection was always more severe on younger leaves than on older ones. Stunting and distortion of young and terminal leaves of growing shoots were also observed. Infected trees did not exhibit symptoms of defoliation. Older, fully developed leaves exhibited few symptoms of the powdery mildew (Fig. 1).

Immature fruits of *P. × acerifolia* also showed colonies of *E. platani* (Fig. 1 C, I, J), together with *A. quisqualis* parasitizing them. In youngest fruits, the infection was more intense and they showed more deformations.

Microscopic Characteristics (Fig. 2).— Mycelium was amphigenous, forming thin to dense colonies. Hyphae were branched, hyaline, smooth, with lobed hyphal appressoria. Conidiophores were erect, 1–3 septate, with straight to flexuous foot cells, and conidia formed singly. The length of the conidiophores, often strongly influenced by external conditions is usually variable. When colonies grew more densely the conidiophores were longer than when they grew more sparsely.

Primary conidia were characterized by having sub-rectangular apices, hyaline, refractive, and measured $31.25\text{--}40\text{ (}\pm 42.5\text{)} \times 12.5\text{--}15\ \mu\text{m}$. Secondary conidia were ellipsoid to doliiform, with slightly convex ends, hyaline, and measured $33.75\text{--}43.75\text{ (}\pm 50\text{)} \times 18.75\text{--}20\ \mu\text{m}$. Conidial germ tubes were produced at one of the ends of conidia. The ascomata of *E. platani* were not observed.

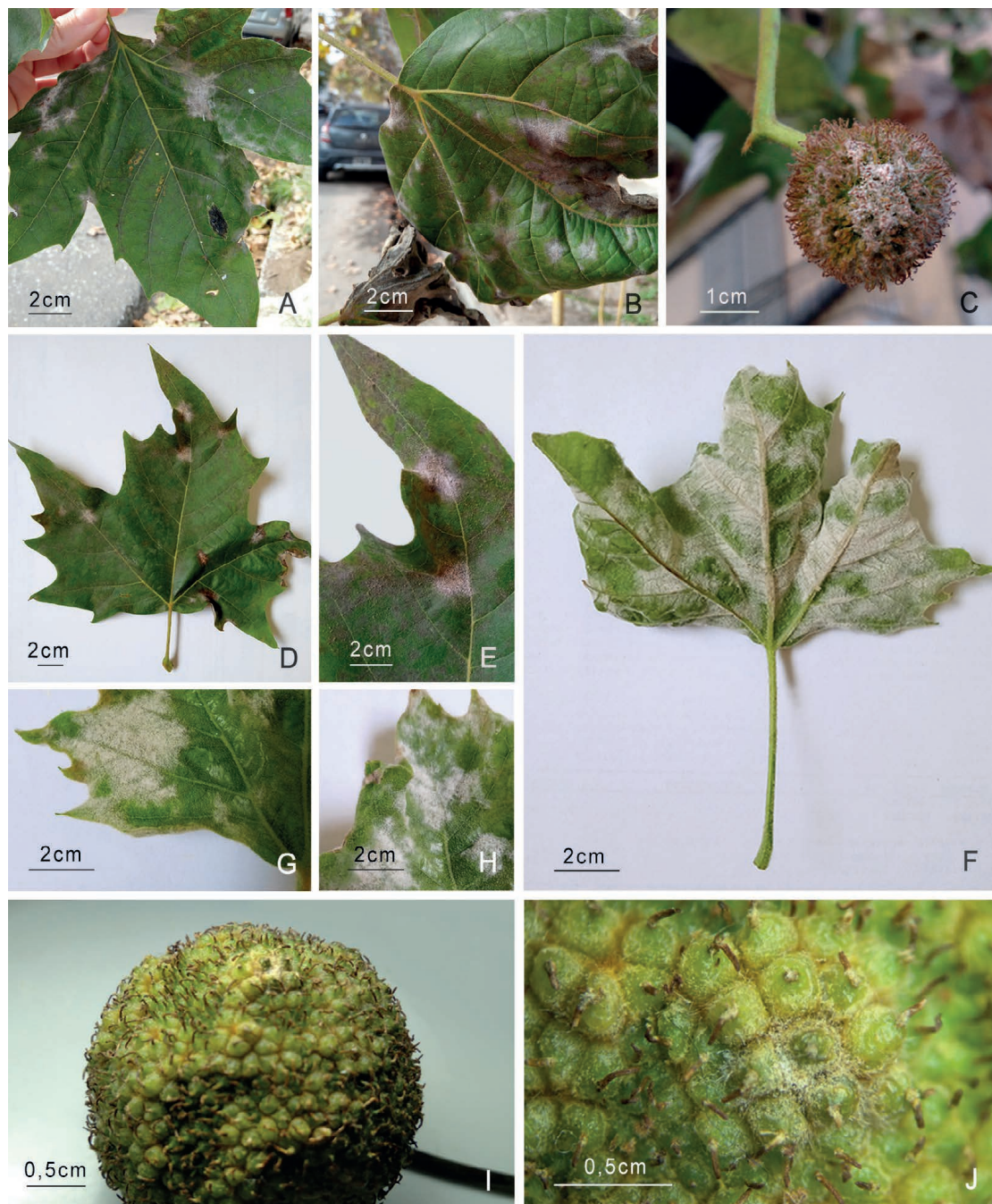


Fig. 1. *Platanus* × *acerifolia* parasited by *Erysiphe platani*. A, B, D-H) Symptomatic leaves. C, I, J) Infected fruits.

Fig. 1. *Platanus* × *acerifolia* parasitado by *Erysiphe platani*. A, B, D-H) Hojas sintomáticas. C, I, J) Frutos infectados.

Mycoparasite (Fig. 3).— *Erysiphe platani* were naturally parasitized by *A. quisqualis*. The infection was seen on colonies of the powdery mildew developing both on leaves as on fruits of *P.* × *acerifolia*.

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, piriform, claviform, elongated or fusi-

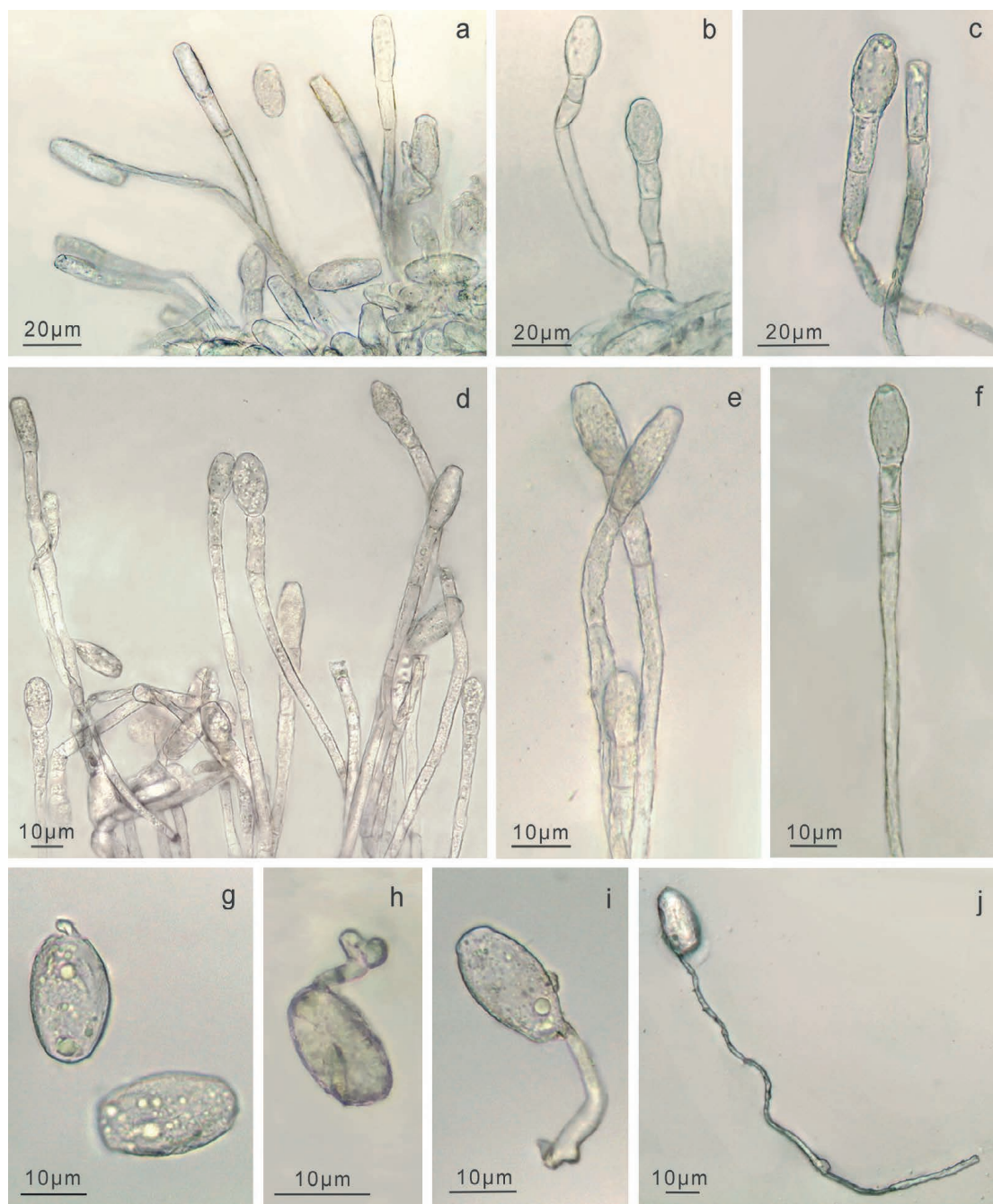


Fig. 2. *Erysiphe platani*. A, B) Conidiophores with primary conidia and secondary conidia free. C) Conidiophore with primary and secondary conidia. D) Conidiophores with terminal conidia. E, F) Secondary conidia. G-J) Conidia with germ tubes.

Fig. 2. *Erysiphe platani*. A, B) Conidióforos con conidio primario y conidios secundarios libres. C) Conidióforo con conidio primario y secundario. D) Conidióforos con conidios terminales. E, F) Conidios secundarios. G-J) Conidios con tubo de germinación.

form) with variable size, according to each shape. When spherical they measured $37.5\text{--}43.75$ (-50) \times $22.5\text{--}35$ (-37.5) μm , when piriform $60\text{--}90$ (-125) \times (-18.75) $20\text{--}27.5$ μm , the elongated to fusiform (-60) $65\text{--}100$ \times $22.5\text{--}27.5$ (-31.25) μm and the claviform ones, $100\text{--}150$ \times $18.75\text{--}25$ μm . The pycnidia produced abundant ellipsoid to oblong hyaline conidia 6.25 (-7.50) \times 2.50 (-3.75) μm .



Fig. 3. Pycnidia of *Ampelomyces quisqualis*. A) General view of numerous pycnidia hyperparasiting *E. platani*. B, D, F) Piriform pycnidia. C, E, G) Conidiomata claviform, elongated or fusiform. H) Pycnidium globose liberating conidia.

Fig. 3. Pycnidios de *Ampelomyces quisqualis*. A) Vista general de numerosos picnidios hiperparasitando *E. platani*. B, D, F) Picnidio piriforme. C, E, G) Conidiomas claviforme, elongado o fusiforme. H) Picnidio globoso liberando conidios.

Selected Specimens examined (all on *Platanus × acerifolia* infected with *Erysiphe platani*).— ARGENTINA. Buenos Aires, CABA, Barrio Retiro (calle San Martín), 34°35'27"S 58°22'19"W, 18 m snm, 23-VIII-2023, *L. Castillo* 1992 (LIL 160893). San Juan, Dpto. Capital (calle Santa Fe), 31°32'19"S 68°30'55"W, 638 m snm, 23-VII-2023, *Romero* 1986 1990 (LIL 160883); (calle Santa Fe), 31°32'18"S 68°30'56"W,

633 m snm, 23-VII-2023, *Romero 1987* (LIL 160881); (calle Santa Fe), 31°32'18"S 68°30'59"W, 640 m snm, 23-VII-2023, *Romero 1988* (LIL 160882); (calle Santa Fe), 31°32'19"S 68°31'05"W, 645 m snm, 23-VII-2023, *Romero 1989* (LIL 160892). Santa Fe, Dpto. Capital (calle Chacabuco 1773), 31°38'04"S 60°41'35"W, 31 m, 10-VI-2023, *D. Alvarez* (LIL 160.896); Capital (calle Chacabuco 1780), 31°38'05"S 60°41'36"W, 30 m, 10-VI-2023, *D. Alvarez* (LIL 160895); Capital (calle Chacabuco 1880), 31°38'04"S 60°41'40"W, 33 m, 10-VII-2023, *D. Alvarez* (LIL 160897); Tucumán, Dpto. San Miguel de Tucumán (calle Estados Unidos 70), 26°49'22"S 65°11'37"W, 446 m snm, 14-V-2023, *L. Castillo 1978* (LIL 160884); 18-V-2023, *L. Castillo 1979* (LIL 160885); (calle General Paz 1300), 26°50'01"S 65°13'05"W, 448 m snm, 16-V-2023, *L. Castillo & G. Suárez 1980* (LIL 160886); (calle 24 de Septiembre 1250), 26°49'43"S 65°12'59"W, 453 m snm, 21-V-2023, *G. Suárez 1981* (LIL 160887); (calle San Lorenzo 1700), 26°49'48"S 65°13'23", 451 m snm, 22-V-2023, *G. Suárez 1982* (LIL 160888); (avenida Mitre 300), 26°49'27"S 65°13'03"W, 456 m snm, 29-V-2023, *G. Suárez 1983* (LIL 160889); (avenida Mitre 800), 26°48'59"S 65°12'55"W, 466 m snm, 29-V-2023, *G. Suárez 1984* (LIL 160890); Dpto. Trancas, San Pedro de Colalao (avenida de la entrada al pueblo), 26°13'58"S 65°29'35"W, 1069 m snm, 28-V-2023, *G. Suárez 1985* (LIL 160891).

CONCLUSIONS

All *Platanus × acerifolia* trees screened for powdery mildew showed strong infections caused by *E. platani*. Younger leaves showed more symptoms of disease than older leaves. Although infections by this powdery mildew were detected previously on trees from other provinces (Buenos Aires and Mendoza), this study constitutes the first record of *E. platani* in Tucumán (NOA), Santa Fe and San Juan.

Erysiphe platani was heavily parasitized by *A. quisqualis*. This hyperparasite, widely distributed throughout the world, is highly studied because of both its ecological importance and its consideration as a putative biocontrol agent. The interactions between powdery mildew fungi (biotrophic parasites of many plants) and pycnidial fungi belonging to the genus *Ampelomyces* are representative of mycoparasitic relationships in nature (Kiss, 1998).

Our results show a parasitic interaction between *A. quisqualis* and the powdery mildew in natural environments of NOA. These observations were extended to infected trees in San Juan and Santa Fe from Argentina.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

BIBLIOGRAPHY

- Braun, U. & Cook, R. T. A. (2012). Taxonomic Manual of the Erysiphales (Powdery Mildews). CBS Biodiversity Series No. 11.
- Braun, U., Kiehr, M. & Delhey, R. (2000). Some new records of powdery mildew fungi from Argentina. *Sydowia* 53 (1): 34-43.
- Heluta, V. P., Korytnianska, V. G. & Akata, I. (2013). Distribution of *Erysiphe platani* (Erysiphales) in Ukraine. *Acta Mycologica* 48 (1): 105-112.
- Kirschner, R. (2011). Observations on *Erysiphe platani* in Germany. *Plant Pathology & Quarantine* 1 (2): 115-119.
- Kiss, L. (1998). Natural occurrence of *Ampelomyces* intracellular mycoparasites in mycelia of Powdery Mildew fungi. *New Phytologist* 140: 709-714.
- Kiss, L. (2008). Chapter 3, Intracellular mycoparasites inaction: interactions between powdery mildew fungi and *Ampelomyces*. In: *British Mycological Society Symposia Series* (pp. 37-52). M.S. Simon, V. Avery and W. Pieter Van (eds.). Academic Press, Waltham, MA.
- Klingner, A. E. (1982). Oidio del platano en las arboledas mendocinas. *Revista de la Facultad de Ciencias Agrarias* 22: 57-60.
- Pastirčáková, K. & Pastirčák, M. (2006). The anamorph of *Erysiphe platani* on *Platanus xhispanica* in Slovakia. *Mycotaxon* 97: 189-194.
- Pastirčáková, K. & Pastirčák, M. (2008). *Erysiphe platani* causing powdery mildew of London plane in Hungary. *Acta Phytopathologica et Entomologica Hungarica* 43 (1): 31-36.