

Some new records and new species of powdery mildew fungi from Mexico

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Abstract: YÁÑEZ-MORALES, Ma. de Jesús, BRAUN, U., MINNIS, A.M. & TOVAR-PEDRAZA, J.M. 2009: Some new records and new species of powdery mildew fungi from Mexico. *Schlechtendalia* **19**: 47–61.

Numerous specimens of powdery mildew fungi have recently been collected in Mexico, including some new records and new hosts. *Oidium elytrariae* sp. nov. on *Elytraria imbricata* and *O. poinsettiae* sp. nov. on *Euphorbia pulcherrima* are described. *Pachyrhizus erosus* is a new host of *Erysiphe diffusa* (with chasmothecia). *Neoerysiphe cumminsiana* has been observed on the new hosts *Dahlia* sp. (with chasmothecia), *Ageratina adenophora* (anamorph), *Galinsoga parviflora* (with chasmothecia), *Tagetes erecta* (anamorph) and *Viguiera helianthoides* (with chasmothecia).

Zusammenfassung: YÁÑEZ-MORALES, Ma. de Jesús, BRAUN, U., MINNIS, A.M. & TOVAR-PEDRAZA, J.M. 2009: Einige neue Angaben und neue Arten von Mehltaupilzen aus Mexiko. *Schlechtendalia* **19**: 47–61.

Zahlreiche Kollektionen von Mehltaupilzen sind unlängst in Mexiko gesammelt worden, einschließlich einiger Neufunde und neuer Wirte. Die neuen Arten *Oidium elytrariae* auf *Elytraria imbricata* und *O. poinsettiae* auf *Euphorbia pulcherrima* werden beschrieben. *Pachyrhizus erosus* ist ein neuer Wirt von *Erysiphe diffusa* (mit Chasmothecien). *Neoerysiphe cumminsiana* wurde auf den neuen Wirten *Dahlia* sp. (mit Chasmothecien), *Ageratina adenophora* (Anamorphe), *Galinsoga parviflora* (mit Chasmothecien), *Tagetes erecta* (Anamorphe) und *Viguiera helianthoides* (mit Chasmothecien) gefunden.

Key words: Ascomycota, Erysiphales, North America, *Oidium elytrariae*, *O. poinsettiae*.

The powdery mildew fungi of Mexico are relatively poorly known. A comprehensive treatment or survey of Mexican species of this important group that causes plant diseases does not yet exist. In 2008 and 2009, several powdery mildew fungi were collected in the Mexican States of Colima (Col.), Estado de México (Edo. de Méx.), Guanajuato (Gto.), Guerrero (Gro.), Michoacan (Mich.), Morelos (Mor.) and Puebla (Pue.); and Mexico, Distrito Federal (D. F.), mainly on cultivated plants and weeds. The identification of the particular species was carried out via cooperation between the authors of this paper. Most of the collections represent anamorphic states of powdery mildews. However, due to new, refined methods and analyses of anamorphic features as well as a better knowledge, in general, of conidial stages of this fungal group, it is now, based on a combination of host identity and morphology, easier to determine powdery mildews without observation of the formation of the teleomorph (chasmoth-

ecial state). A survey of conidial characters useful for determination has been given by BRAUN et al. (2002). The taxonomy and nomenclature of the Erysiphales follows BRAUN (1987), updated and supplemented by BRAUN (1999), BRAUN & TAKAMATSU (2000) and BRAUN et al. (2002). The particular samples have been examined in gently heated lactic acid. Duplicates of all collections are deposited in the herbarium of the Martin-Luther-University, Halle, Germany (HAL) as well as the herbarium of the Colegio de Postgraduados, Campus Montecillo, Orientación Fitopatología, Montecillo, Texcoco, Edo. de Méx., Mexico (CMPH). Some historical specimens used to supplement the data from the new Mexican collections are housed in the U.S. National Fungus Collections, Beltsville, Maryland, USA (BPI).

(1) *Erysiphe betae* (Vaňha) Weltzien (*Oidium cylindricum* Sawada, nom. inval.)

On *Chenopodium ambrosioides* (Chenopodiaceae), Mexico, Colegio de Postgraduados, Montecillo, Municipality (Mpio.) de Texcoco, Edo. de Méx., 10 Jul. 2008, Ma. de Jesús Yáñez-Morales (anamorph); Mexico, Celaya, Gto., 16 Feb. 2008, Cinthia Martínez Sánchez (anamorph). On *Chenopodium album*, Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 5 Jul. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

New on these hosts in Mexico. This species is common and widespread on *Beta vulgaris*. Records on *Chenopodium album*, *C. ambrosioides* and *Chenopodium* sp. are known from Australia, Asia (e.g. Japan, India), Europe, South America (Argentina) and the USA (AMANO 1986, BRAUN 1987, 1995; BRAUN et al. 2000, PAUL & THAKUR 2006).

(2) *Erysiphe cruciferarum* Opiz ex L. Junell

On *Sisymbrium* sp. (Brassicaceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 17 Aug. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

Probably new to Mexico.

(3) *Erysiphe diffusa* (Cooke & Peck) U. Braun & S. Takam.

On *Pachyrhizus erosus* (Fabaceae), Mexico, Alpoeyca, Mpio. de Huamuxtitlan, Gro., 10 Jan. 2009, Juan Manuel Tovar Pedraza (anamorph and teleomorph).

Pachyrhizus erosus is a new host genus and species for *E. diffusa*. Abundant chasmothecia fully agreeing with BRAUN's (1987) description of this species are present. The anamorph of *E. diffusa*, which is insufficiently known, can be described as follows (**Fig. 1**): Appressoria slightly to moderately lobed, solitary or in opposite pairs, 3–7 µm diam.; conidiophores erect, straight, foot-cells cylindrical, straight to slightly curved or flexuous, 25–50 × 5–9 µm, followed by 1–2 shorter cells; conidia solitary, ellipsoid-doliiform, subcylindrical, 25–35(–40) × 14–18 µm.

AMANO (1986) listed '*Erysiphe communis*' on *Pachyrhizus erosus* from El Salvador and *Oidium* spp. on *P. tuberosus* and *Pachyrhizus* sp. from Cuba, El Salvador and Guatemala.

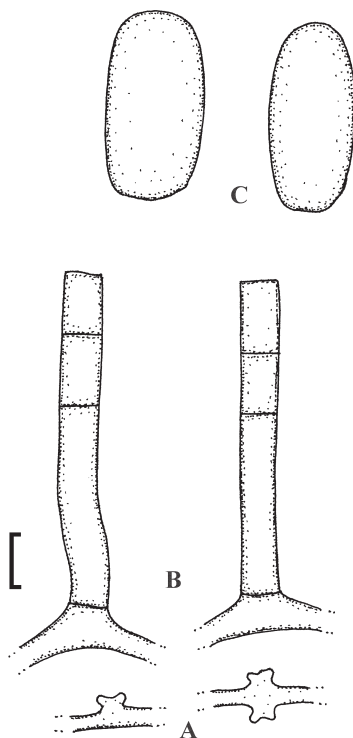


Fig. 1: *Erysiphe diffusa* on *Pachyrhizus erosus*, anamorph, **A** – appressoria, **B** – conidiophores, **C** – conidia. Bar = 10 μ m (U. Braun del.).

(4) *Erysiphe heraclei* DC.

On *Coriandrum sativum* (Apiaceae), Mexico, La Trinidad Tepanco, Mpio. de Atlixco, Pue., 12 Nov. 2008, Aaron González Morales (anamorph).

Coriandrum sativum is known as host of *E. heraclei*, especially in Asia (AMANO 1986, PAUL & THAKUR 2006).

(5) *Erysiphe pisi* DC.

On *Phaseolus vulgaris* (Fabaceae), Mexico, INIFAP-Valle de México, Chapingo, Texcoco, Edo. de Méx., 17 Oct. 2008, Patricia Rivas Valencia (anamorph); Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 17 Aug. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

A collection from Mexico deposited at BPI [on *Phaseolus vulgaris*, Puente de Ixtla, Mor. 19 Apr. 1953, L. Bucio, detr. M. Zenteno, BPI 565118, as '*E. polygoni*' (anamorph)] almost certainly represents this taxon.

This species has already been listed from Mexico on bean by AMANO (1986). This is a confirmation of the occurrence of this species in Mexico.

(6) *Erysiphe polygoni* DC.

On *Polygonum aviculare* (Polygonaceae), Mexico, CESAVEDF, San Andrés Mixquic, Delegación Tláhuac, D. F., 27 Oct. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

This species is common and widespread on this weed (BRAUN 1987), and it was previously recorded from Mexico on *Polygonum* sp. by ALVAREZ (1976). This is a confirmation of the occurrence of this species in Mexico.

(7) *Erysiphe quercicola* S. Takam. & U. Braun (*Oidium anacardii* F. Noack, *Oidium citri* (J.M. Yen) U. Braun)

On *Citrus ×limon* (Rutaceae), Mexico, Tenancingo, Mpio. de Tlalchapa, Edo. de Méx., 10 Feb. 2008, Juan Manuel Tovar Pedraza (anamorph); Villa Guerrero, Edo. de Méx., 10 Feb. 2008, Juan Manuel Tovar Pedraza (anamorph); Mpio. de Ocuituco, Mor., 8 Mar. 2008, Juan Manuel Tovar Pedraza (anamorph); La Purificación, Mpio. de Texcoco, Edo. de Mex., 26 May 2008, Juan Manuel Tovar Pedraza (anamorph); Tlacotepec de José Manzo, Mpio. de San Salvador el Verde, Pue., 31 Oct. 2008, Enrique González Pérez (anamorph).

WELLMAN (1977) reported powdery mildew on *Citrus* spp. from Mexico. ALVAREZ (1976) and AMANO (1986) listed *Oidium tingitaninum* C.N. Carter from Mexico on *Citrus sinensis* and *Citrus* sp. This taxon has an anamorph characterised by nipple-shaped appressoria, catenate conidia and much wider conidiophores. *Oidium citri* is, however, a member of *Oidium* subgen. *Pseudoidium* (Y.S. Paul & J.N. Kapoor) R.T.A. Cook et al. with lobed appressoria and conidia formed singly. LIMKAISANG et al. (2006) and TAKAMATSU et al. (2007) demonstrated by molecular sequence analyses that anamorphic powdery mildews on several tropical trees, viz. *Acacia*, *Anacardium*, *Bixa*, *Citrus* and *Mangifera* spp., belong to the oak powdery mildew *Erysiphe quercicola*. Thus, the oldest name *Oidium anacardii* is now considered the correct name for the anamorph of *E. quercicola*, and *Oidium citri*, *O. heveae* B.A. Steinm. and *O. mangiferae* Berthet are considered to be synonyms.

A first record on *Citrus ×limon* in Mexico has already been published as *O. citri* in an abstract for a poster presented at a congress in Mexico (TOVAR PEDRAZA et al. 2008). BOESEWINKEL (1981) discussed powdery mildew on *Citrus* spp. in detail. He examined type material of *O. tingitaninum* and demonstrated that this species is only known from California. All other records of this species refer to an anamorph agreeing with *O. citri* now known as *O. anacardii* (appressoria lobed, conidia formed singly). Based on inoculation experiments carried out in New Zealand and morphological similarities, BOESEWINKEL (1981) incorrectly assigned this *Oidium* to *Microsphaera euonymi-japonici* Vienn.-Bourg. Records of the latter species in AMANO (1986) undoubtedly refer to BOESEWINKEL (1981). TAKAMATSU et al. (2007) included anamorphs on *Euonymus japonicus* from Japan and Argentina in molecular sequence analyses. These fungi clustered within the

Erysiphe alphitoides (Griffon & Maubl.) U. Braun & S. Takam./*E. quercicola* complex with only one base pair being different from *E. alphitoides* (= *Microsphaera alphitoides* Griffon & Maubl.). It is possible that *Euonymus japonicus* may be infected by *E. alphitoides* as well as *E. quercicola* as demonstrated for mango (see TAKAMATSU et al. 2007). BOESEWINKEL (1981), probably referring to WELLMAN (1977), listed '*M. euonymi-japonici*' also from Mexico on sweet orange and *Citrus* sp., but he did not examine any Mexican samples.

(8) ***Golovinomyces ambrosiae*** (Schwein.) U. Braun & R.T.A. Cook [= *Erysiphe ambrosiae* Schwein., = *G. cichoracearum* var. *latisporus* (U. Braun) U. Braun]

On *Helianthus annuus* (Asteraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 29 Jun., 13 and 15 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph); *Simsia* sp., Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 15 Sep. and 1 Oct. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

A collection of this variety from Mexico is deposited at BPI [on *Helianthus annuus*, Campo Experimental en León, Gto., 10 Oct. 1948, J.S. Neederhauser, det. M. Zenteno, J. Mondragón, BPI 560561, as '*E. cichoracearum*' (anamorph)].

Simsia is a new host genus for *G. ambrosiae* (COOK & BRAUN 2009).

(9) ***Golovinomyces cichoracearum*** (DC.) Heluta s. lat.

On *Aster* sp. (Asteraceae), Mexico, Santa Ana, Mpio. de Tenango del Valle, Edo. de Méx., 10 Feb. 2008, Luis Alfonso Aguilar Pérez (anamorph). On *Dahlia pinnata*, Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 23 Jun. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Tanacetum parthenium*, Mexico, Mpio. de Ixtlahuaca, Edo. de Méx., 13 Mar. 2008, Leticia Robles Yerena (anamorph). On *Taraxacum officinale*, Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 29 Jun. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

A specimen from Mexico deposited at BPI [on *Zinnia* sp., ex Mexico, intercepted at Brownsville, Texas, 11 Oct. 1940, C.G. Anderson, det. C.G. Anderson, A.J. Watson, BPI 562011, as '*E. cichoracearum*' (anamorph)] represents this species.

The synonym, *Erysiphe cichoracearum*, has been listed in ALVAREZ (1976) and AMANO (1986) for Mexico. *G. cichoracearum* can be confirmed by these collections, and it has been collected in Mexico on several hosts and seems to be rather common.

(10) ***Golovinomyces orontii*** (Castagne) Heluta s. lat.

On *Hibiscus sabdariffa* (Malvaceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 20 Oct. 2008, Juan Manuel Tovar Pedraza (anamorph).

This powdery mildew is known from South America (DELHEY et al. 2003), but new to Mexico. AMANO (1986) recorded *Oidium* sp. on this host from South America.

(11) *Leveillula taurica* (Lév.) G. Arnaud

On *Capsicum annuum* (Solanaceae), Mexico, Tepoztlan, Mor., 8 Jan 2008, Alfricia Adriana de los Santos Villamil (anamorph). On *Solanum lycopersicum* [*Lycopersicon esculentum*], Mexico, Tlayacapan, Mor., 8 Mar. 2008, Maricarmen Sandoval Sánchez (anamorph). On *Ruta graveolens* (Rutaceae), Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 11 Nov. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Tropaeolum majus* (Tropaeolaceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 24 Jun. 2008, Juan Manuel Tovar Pedraza (anamorph); La Purificación, Mpio. de Texcoco, Edo. de Méx., 12 Oct. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

Anamorphs of *L. taurica* have been found in Mexico on several hosts, indicating that this species is probably not uncommon in this country. It was previously reported from Mexico by ALVAREZ (1976) on *Prosopis* spp. (Fabaceae) and AMANO (1986) on *Capsicum frutescens* (Solanaceae).

(12) *Neoerysiphe cumminsiana* (U. Braun) U. Braun

On *Dahlia* sp. (Asteraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 8 Oct. 2008, Ma. de Jesús Yáñez-Morales and Juan Manuel Tovar Pedraza (anamorph and teleomorph). On *Galinsoga parviflora*, Mexico, D. F., 16 Aug. 2008, Ma. de Jesús Yáñez-Morales (anamorph); Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 13 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Tagetes erecta* (Asteraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 24 Oct. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

Collections from Mexico deposited at BPI on *Ageratina adenophora* [Cuernavaca, Mor., 26 Apr. 1965, N.L.H. Krauss, det. C.R. Benjamin, BPI 560293, as '*E. cichoracearum*' (anamorph)], *Galinsoga parviflora* [México State (Méx), 16 Sep. 1903, J.N. Rose, J.H. Painter, det. F.W. Patterson, BPI 560395 & BPI 560396, as '*E. cichoracearum*?' (teleomorph)] and *Viguiera helianthoides* [near city of Aguascalientes, Ags., 9 Oct. 1903, J.N. Rose, J.H. Painter, BPI 561947 & BPI 561948, as '*E. cichoracearum*' (predominantly teleomorph, very few conidia)] refer to *N. cumminsiana*.

New to Mexico on new host species. The collections of this species on the five new hosts including the numerous chasmothecia found on some plant hosts have been surprising. It seems that *N. cumminsiana* is a more common and widespread powdery mildew on composites that is often confused with *Golovinomyces cichoracearum* as recently supposed by VOYTYUK et al. (2006).

(13) *Oidium caricae* F. Noack

On *Carica papaya* (Caricaceae), Mexico, Huamuxtitlan, Mpio. de Huamuxtitlan, Gro., 10 Jan. 2009, Juan Manuel Tovar Pedraza.

ALVAREZ (1976) recorded *Oidium caricae* on *Carica papaya* from Mexico, and AMANO (1986) recorded '*Erysiphe communis*' on *Carica papaya* from Mexico. These records probably refer to *O. caricae*. However, the latter name has previously been

confused with other powdery mildew anamorphs on papaya. BRAUN (1987) considered this name the anamorph of *Podosphaera caricae-papayae* (Tanda & U. Braun) U. Braun & S. Takam. (= *Sphaerotheca caricae-papayae* S. Tanda & U. Braun), which is, however, wrong. LIBERATO et al. (2004) re-examined and discussed the whole complex of powdery mildews on papaya, proposed an epitype for *O. caricae* and confined this name to the common and widespread papaya powdery mildew belonging in *Oidium* subgen. *Pseudoidium* (appressoria lobed; conidia formed singly, long, cylindrical, $30\text{--}60 \times 15\text{--}25\text{ }\mu\text{m}$). The type material of this species, deposited at K, is now almost devoid of any fungal colonies. Due to the long-lasting and strong confusion of existing *Oidium* names described from papaya, the exact host range of *O. caricae* is still unclear. LIBERATO et al. (2004) cited proven records from Brazil, Portugal and Venezuela. This is the first clear record from Mexico.

(14) *Oidium elytrariae* Orozco-Santos, Yáñez-Morales & U. Braun, **sp. nov.** Fig. 2
Mycobank, MB 513021

Holotype: On *Elytraria imbricata* (Acanthaceae), Mexico, Pueblo Juárez, Mpio. de Coquimatlán, Col., 31 Oct. 2008, Mario Orozco-Santos (HAL 2313 F). Isotype: CMPH.

Mycelium amphigenum, gracile, effusum vel in maculis albidis, deinde confluentibus, folias obtegentes; hyphae rectae vel flexuosae, ramosae, septatae, tenuitunicatae, laeves, $3\text{--}8\text{ }\mu\text{m}$ diam. Conidiophora $1\text{--}2$ pro cellula hyphae, positione centrali vel non centrali, erecta, terminalia vel lateral, $(20\text{--})25\text{--}90\text{--}(110)\text{ }\mu\text{m}$ longa, cellulis basalibus rectis, cylindratis vel modice curvatis, flexuosis-sinuosis, $15\text{--}50 \times 5\text{--}9\text{ }\mu\text{m}$, cellulis sequentibus $(0\text{--})1\text{--}3$, brevioribus, subaequalibus, raro longioribus, ad $10\text{ }\mu\text{m}$ diam. Conidia solitaria, ellipsoidea-ovoidea, doliiformia vel cylindrica, $20\text{--}40 \times 10\text{--}15\text{ }\mu\text{m}$, ratione longitudinis/latitudinis $1.6\text{--}3.6$, tubulis germinalibus subapicalibus, ad $45 \times 3\text{--}9\text{ }\mu\text{m}$, saepe cum septo singulo, apice simplici, leviter inflato vel lobato.

Mycelium amphigenous, thin, effuse or white patches, later confluent, forming covers; hyphae straight to flexuous, branched, septate, thin-walled, smooth, $3\text{--}8\text{ }\mu\text{m}$ wide; appressoria solitary or in opposite pairs, nipple-shaped or slightly to distinctly lobed, $3\text{--}10\text{ }\mu\text{m}$ diam.; conidiophores solitary or up to two per hyphal cell, position between two hyphal septa central to somewhat non-central, occasionally distinctly non-central (near to a septum), erect, terminally to laterally arising, $(20\text{--})25\text{--}90\text{--}(110)\text{ }\mu\text{m}$ long, foot-cells straight, cylindrical to moderately curved or flexuous-sinuuous, usually terminally arising from the supporting hypha, $15\text{--}50 \times 5\text{--}9\text{ }\mu\text{m}$, followed by $(0\text{--})1\text{--}3$ shorter cells or second cell about as long as the foot-cell, occasionally followed by a single somewhat longer cell, width of the following cells about as wide as the foot-cell or somewhat increasing in width, up to $10\text{ }\mu\text{m}$; conidia formed singly, ellipsoid-ovoid, doliiform to cylindrical, $20\text{--}40 \times 10\text{--}15\text{ }\mu\text{m}$, length/width ratio $1.6\text{--}3.6$, germ tubes subterminal, short to moderately long, up to $45 \times 3\text{--}9\text{ }\mu\text{m}$, often with a single septum somewhat distant from the conidium, apex undifferentiated, somewhat swollen to distinctly lobed.

Notes: BRAUN (1987) did not treat any powdery mildew fungi with anamorphs belonging in *Oidium* subgen. *Pseudoidium* (= *Erysiphe* DC. emend.) from this host. BOESEWINKEL (1979) identified and

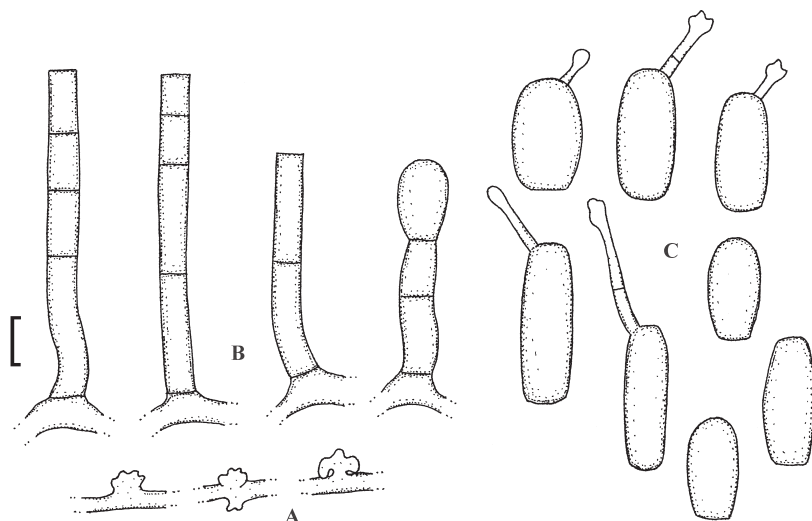


Fig. 2: *Oidium elytrariae* on *Elytraria imbricata*, **A** – appressoria, **B** – conidiophores, **C** – conidia. Bar = 10 μ m (U. Braun del.).

discussed ‘*Microsphaera polonica* Siemaszko’ (nom. confus., type composed of *Erysiphe friesii* (Lév.) U. Braun & S. Takam. and *Oidium hortensiae* Jørst.) on *Acanthus mollis* from New Zealand. Based on morphological similarities, he supposed that powdery mildew from *Hydrangea macrophylla* was able to infect nearby *Acanthus mollis*. However, the true *Oidium hortensiae* on *Hydrangea* is easily distinguishable from *O. elytrariae* by conidiophores with straight foot-cells often followed by a longer cell. Furthermore, the conidia are wider, (14–)16–19(–20) μ m (BRAUN 1987, BOESEWINKEL 1979). Otherwise, only the chain-forming powdery mildews *Golovinomyces orontii* (*Oidium violae* Pass.), *Podosphaera* sp. and *Neoerysiphe galeopsidis* (DC.) U. Braun are known on hosts of the Acanthaceae [*Acanthus* spp. and *Thubergia* spp.] (AMANO 1986, BRAUN 1987, ING 1990, COOK et al. 2006).

(15) *Oidium hortensiae* Jørst.

On *Hydrangea* sp. (Hydrangeaceae), Mexico, Texcoco, Edo. de Méx., 16 Jun. 2008, Ma. de Jesús Yáñez-Morales.

New to Mexico.

(16) *Oidium neolycopersici* L. Kiss

On *Solanum lycopersicum* [*Lycopersicum esculentum*] (Solanaceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 26 Sep. 2008, Ma. de Jesús Yáñez-Morales.

This common, widespread agent of tomato disease is known from Mexico (RODRÍGUEZ-ALVARADO et al. 2007). AMANO (1986) recorded *Oidium* sp. from this country for this host.

(17) *Oidium poinsettiae* U. Braun, Minnis & Yáñez-Morales, **sp. nov.** **Fig. 3**
 MycoBank, MB 513022

Holotype: On *Euphorbia pulcherrima* (Euphorbiaceae), USA, New York, Riverhead, Long Island Horticultural Research Laboratory, Feb. 1994, M. Daughtrey (HAL 1674 F).

Differt ab *Oidio E. euphorbiicolae* conidiophoris apicem versus (in cellulis sequentibus) saepe leniter latoribus, cellulis basalibus plerumque flexuosis-sinuosis.

Other material from Honduras and Mexico (paratypes): On *Euphorbia heterophylla*, Honduras, Dept. Morazán, vicinity of El Zamorano, between 17 Feb. and 8 Mar. 1947, P.C. Stanley (BPI 558180). On *Euphorbia pulcherrima*, Mexico, D.F., 20 Sep. 2008, Ma. de Jesús Yáñez-Morales (CMPH); Mexico, Ixtacaró, Mpio. de Salvador Escalante, Mich., 27 Sep. 2008, Ramón Villanueva Arce (CMPH).

Mycelium amphigenous, forming white patches, thin; hyphae branched, septate, thin-walled, smooth, 3–8 µm wide; appressoria solitary, occasionally in opposite pairs, nipple-shaped to lobed, 2–8 µm diam.; conidiophores usually solitary, position between two hyphal septa more or less central to non-central, erect, up to about 90 µm long, foot-cells usually distinctly flexuous-sinuuous, occasionally curved or almost straight, terminally to usually laterally arising from the supporting hypha, 20–40 × 5–9 µm, followed by 1–2 shorter cells, occasionally followed by a single cell about as long as the foot-cell, following cells often somewhat wider than the foot-cell, 8–12 µm; conidia formed singly, rarely in short chains, ellipsoid-ovoid, doliform to cylindrical, 25–35(–40) × (10–)12–18(–20) µm.

Notes: *Euphorbia pulcherrima* is a species native in Mexico. The powdery mildew on poinsettia belongs in *Oidium* subgen. *Pseudoidium* (appressoria lobed; conidia formed singly). It is known from Costa Rica, El Salvador, Guatemala, Mexico, Puerto Rico and has been sporadically introduced to the USA and Europe [Denmark, Germany, Sweden, UK] (AMANO 1986, DAUGHTREY & HALL 1992, DAUGHTREY & MACKSEL 1994, MOTTE & UNGER 1995, CELINO & HAUSBECK 1997, 1998; KOIKE & SAENZ 1998, BENSON et al. 2002, ANONYMOUS 2004, BRIELMAIER-LIEBETANZ & PFEILSTETTER 2004). BENSON et al. (2002) stated that this *Oidium* has no known hosts other than the poinsettia. However, in artificial inoculation experiments under greenhouse conditions carried out in Germany, the poinsettia *Oidium* could be transferred to *Euphorbia exigua*, *E. heterophylla*, *E. helioscopia* and to a lesser extent to *E. marginata* (BRIELMAIER-LIEBETANZ & PFEILSTETTER 2004). A single specimen collected in Honduras on *Euphorbia heterophylla* fully agreeing with the poinsettia *Oidium* has been examined. *Oidium* sp. agreeing with *O. poinsettiae*, *Podosphaera euphorbiae* (E.S. Salmon) U. Braun & S. Takam., *Leveillula clavata* Nour and *L. taurica* (Lév.) G. Arnaud have been found in the UK on poinsettias (ANONYMOUS 2004).

Previously, it had been supposed that the poinsettia *Oidium* may be the anamorph of the widespread North American *Erysiphe euphorbiicola* U. Braun & S. Takam. (= *Microsphaera euphorbiae* Berk. & M.A. Curtis). However, the anamorph of the latter species is easily distinguishable from the poinsettia powdery mildew by having cylindrical conidiophores, always terminally arising from the supporting hypha (BRAUN 1987). The foot-cells are usually straight, but occasionally they can be somewhat curved to flexuous, in which case they also arise terminally from the supporting hypha. Thus, the causal agent of the poinsettia powdery mildew cannot be *Erysiphe euphorbiicola*. The anamorphs in some additional specimens of the latter species have been re-examined to confirm BRAUN's (1987) observations, description and drawing [on *Euphorbia corollata*, USA, Illinois, Oregon, 10 Sep. 1889, M.B. Waite 164 (HAL 136 F); West Virginia, Fort Spring, 23 Sep. 1904, J.L. Sheldon (BPI 558124), as '*Microsphaera euphorbiae*' (anamorph and teleomorph); and an additional 27 samples on this host from BPI; on *E. marginata*, USA, Kansas, Manhattan, Riley Co., 1 Oct. 1889, Kellerman & Swingle, Kansas Fungi 2513 (BPI 558184), as

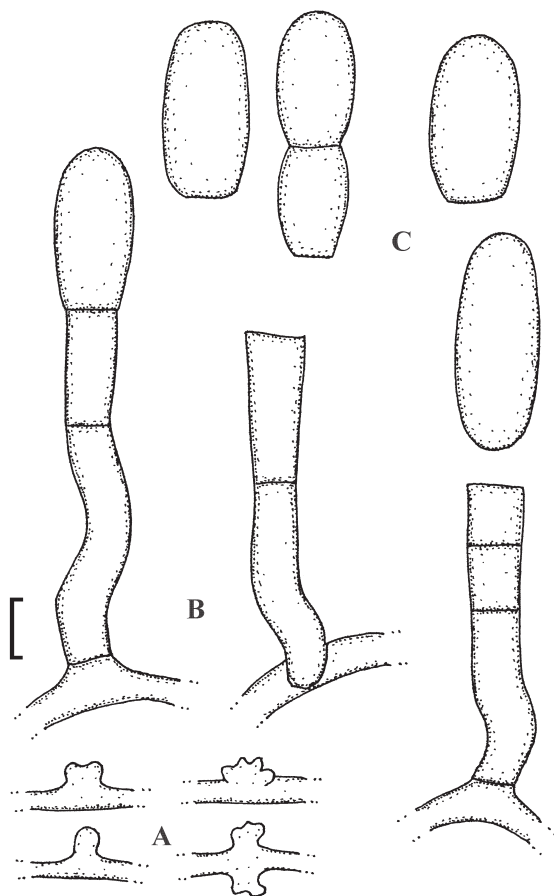


Fig. 3: *Oidium poinsettiae* on *Euphorbia pulcherrima*, **A** – appressoria, **B** – conidiophores, **C** – conidia. Bar = 10 μm (U. Braun del.).

'*Microsphaera euphorbiae*' (anamorph and teleomorph); and in addition BPI 558183, 558185 on this host; on *E. nutans* ($\equiv$ *Chamaesyce nutans*, = *E. preslii*), USA, Missouri, Starkville, Oct. 1894, S.M. Tracy, Ellis & Everh., Fungi Columb. 927 (BPI 558188), as '*Microsphaera euphorbiae*' (anamorph and teleomorph); Texas, Austin, Sep.–Dec. 1914, B.L. Tharp (BPI 558186), as '*Microsphaera euphorbiae*' (anamorph and teleomorph); and in addition BPI 558187, 558189 on this host]. The anamorph of *E. euphorbiticola* is characterised as follows (**Fig. 4**): Appressoria nipple-shaped to lobed; conidiophores erect, 30–70 μm long, terminally arising from the supporting hypha, foot-cells straight, cylindrical, occasionally somewhat curved to flexuous, 10–30 $\times$ 6–10 μm , followed by 0–2 shorter cells or cells about as long as the foot-cell, second cell occasionally somewhat longer than the foot-cell; conidia formed singly, ellipsoid-ovoid to cylindrical, 25–35 $\times$ 12–18 μm .

(18) *Oidium tamarindi* (J.M. Yen) U. Braun

On *Tamarindus indicus* (Fabaceae), Mexico, Texcoco, Edo. de Méx., Dec. 2007, Ma. de Jesús Yáñez-Morales; Pueblo Juárez, Mpio. Coquimatlán, Col., 31 Oct. 2008, Mario Orozco Santos.

This species, which is known from Asia and Africa (BRAUN 1987), is new to Mexico. A first record has already been published in an abstract for a poster presented at a congress in Mexico (YÁÑEZ-MORALES et al. 2008).

(19) *Oidium* sp.

On *Eschscholzia californica* (Papaveraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 7 Jul. 2008, Ma. de Jesús Yáñez-Morales.

Braun (1987) listed several species of *Glaucium*, *Meconopsis* and *Papaver* as hosts of *Erysiphe cruciferarum*. The *Oidium* on *E. californica* resembles the latter species, above all due to its long, slender, cylindrical conidia, $35-45(-55) \times 12-18 \mu\text{m}$, but it differs in having longer conidiophores, up to $120 \mu\text{m}$. The foot-cells of the conidiophores are straight as in *E. cruciferarum*, but also longer, $30-70 \times 6-9 \mu\text{m}$. The identity of this anamorph remains unclear.

(20) *Podosphaera fusca* (Fr.) U. Braun & Shishkoff

On *Conyza bonariensis* (Asteraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 7 Jul. 2008, Ma. de Jesús Yáñez-Morales (anamorph); *Taraxacum officinale*, Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 17 Aug. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

Probably new to Mexico, but AMANO (1986) reported '*Sphaerotheca fuliginea*' on *Physalis lagascae* (Solanaceae) and *Sanvitalia procumbens* (Asteraceae) from Mexico. Collections on *Conyza* and *Taraxacum* spp. have often been recorded previously as '*Sphaerotheca fuliginea*.' The current taxonomy and nomenclature follows BRAUN & TAKAMATSU (2000) and BRAUN et al. (2002).

(21) *Podosphaera pannosa* (Wallr. : Fr.) de Bary

On *Prunus armeniaca* (Rosaceae), Mexico, Universidad Autónoma Chapingo, Texcoco, Edo. de Méx., 19 Aug. 2008, Juan Manuel Tovar Pedraza; Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 29 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Prunus persica*, Mexico, Villa Guerrero, Edo. de Méx., 9 Mar. 2008, Juan Manuel Tovar Pedraza (anamorph); Mexico, D.F., 27 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Rosa* sp., Mexico, Lima de Santiago, Mpio. de Villa Guerrero, Edo. de Méx., 16 Feb. 2008, Lauro Soto Rojas (anamorph); Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 9 Mar. 2008, Leticia Robles Yerena (anamorph).

This is a common cosmopolitan powdery mildew previously recorded by ALVAREZ (1976). AMANO (1986) listed this species from Mexico on *Prunus persica* and *Rosa* sp.

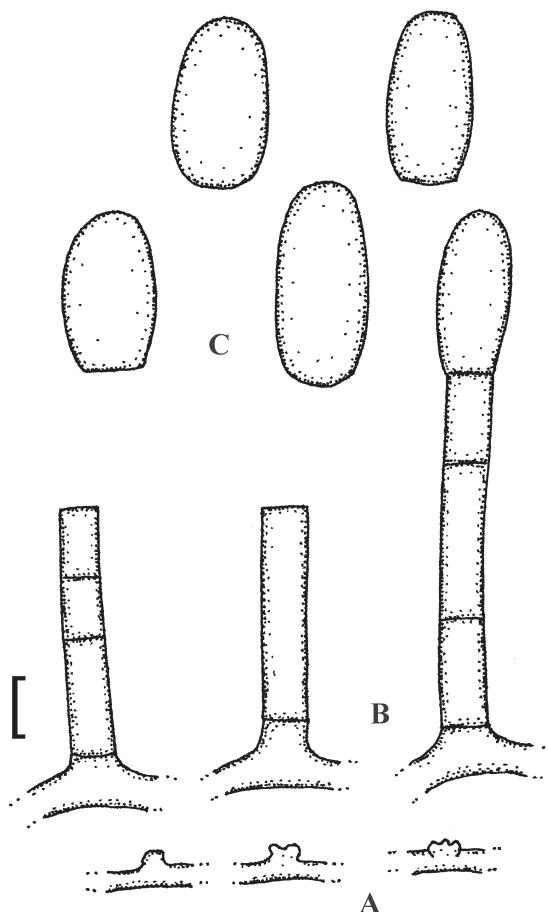


Fig. 4: *Erysiphe euphorbiicola* on *Euphorbia corollata*, anamorph, **A** – appressoria, **B** – conidiophores, **C** – conidia. Bar = 10 μ m (U. Braun del.).

(22) *Podosphaera xanthii* (Castagne) U. Braun & Shishkoff (= *Sphaerotheca calendulae* (Malbr. & Roum.) Roum., = *S. cucurbitae* (Jacz.) Z.Y. Zhao)

On *Calendula officinalis* (Asteraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 13 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Cucumis sativus* (Cucurbitaceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 26 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Cucurbita pepo*, Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 29 Jun. 2008, Ma. de Jesús Yáñez-Morales (anamorph). On *Cucurbita maxima*, Mexico, Universidad Autónoma

Chapingo, Texcoco, Edo. de Mex., 11 Apr. 2008, Liliana Salazar Ordaz (anamorph); Tlacotepec de José Manzo, Mpio. de San Salvador el Verde, Pue., 16 Sep. 2008, Ana Espinoza Ortega (anamorph). On *Cucurbita moschata*, Mexico, La Soledad, Mpio. de Atlitxco, Pue., 12 Nov. 2008, Aaron González Morales (anamorph).

This species is known on cucurbits from Mexico. AMANO (1986) recorded it from this country on *Cucurbita pepo* and *Cucurbita* sp. as '*Sphaerotheca fuliginea*', and ALVAREZ (1976) possibly did as well on *Cucurbita pepo* as '*Sphaerotheca humuli*'. The current taxonomy and nomenclature follows BRAUN & TAKAMATSU (2000) and BRAUN et al. (2002).

(23) *Sawadaea bicornis* (Wallr. : Fr.) Miyabe

On *Acer* sp. (Aceraceae), Mexico, Colegio de Postgraduados, Montecillo, Mpio. de Texcoco, Edo. de Méx., 15 Sep. 2008, Ma. de Jesús Yáñez-Morales (anamorph).

New to Mexico. The host is a cultivated, ornamental tree.

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