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SHORT COMMUNICATION

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Chaconia hennenii, a new holomorph species for *Uredo maclurae* and *Uredo celtidis* (Uredinales)

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Abstract *Chaconia hennenii* is proposed as a new holomorph species for *Uredo maclurae* (= *Physopella maclurae*) on *Maclura tinctoria* (Moraceae) after the discovery of teliospores. *Uredo celtidis* described on *Celtis* (Ulmaceae) is synonymous with *U. maclurae* and belongs to the same holomorph species, as revealed by morphologically indistinguishable urediniospores and newly discovered teliospores. The host genus of *U. celtidis* is not *Celtis*, but most probably *Maclura*, too. *Chaconia hennenii* is unique among known *Chaconia* species by the apical wall thickening of the teliospores.

Key words *Celtis* · Chaconiaceae · *Maclura* · *Physopella* · Rust fungi

A study of the uredinial rust fungus *Uredo maclurae* Speg. [= *Physopella maclurae* (Speg.) Arthur] on *Maclura tinctoria* (L.) D. Don ex Steud. (Moraceae) revealed the presence of telia that had not been previously described. In this article, a new species, *Chaconia hennenii*, is proposed for the holomorph and compared to other known *Chaconia* species and the morphologically similar *Uredo celtidis* Pazschke described from the host genus *Celtis* (Ulmaceae).

Herbarium specimens examined are listed under the species description. Roman numerals indicate which spore stages are present on the respective specimens (II for uredinia, III for telia). Names of herbaria are abbreviated by their acronyms according to *Index Herbariorum* (Holmgren et al. 1990). Spores and hand sections of herbarium material were embedded in a droplet of lactophenol solution on a microscopic slide glass and gently heated to boiling. The preparations were examined with an Olympus BX51 light microscope and micrographs taken with a ColorView IIIu camera. The "Cell*B" software package (Software Imaging System) was used to capture and edit micrographs and to measure details of spore walls and their ornamentation. In the latter case, measurements are given to 0.1 μm; ordinary measurements made by the use of an ocular micrometer scale are given to 0.5 μm. At least 25 spores were measured for each specimen and spore stage. Infected host leaves were scanned with a HP Scanjet 4890 flatbed scanner.

Synonymy of *Uredo maclurae* Speg. and *U. celtidis* Pazschke

Rust of *Maclura mora* Griseb. was first described by Spegazzini (1884) as *Uredo maclurae* from Guarapi, Brazil. Arthur (1906) proposed the new combination *Physopella maclurae* (Speg.) Arthur, assuming that the rust would belong to the teleomorph genus *Physopella* of Phakopsoraceae. For some time *Physopella* has been used alternatively to designate a uredinial anamorph genus (Ono et al. 1992), but Cummins and Hiratsuka (2003) retained it as a telial genus and synonym of *Phakopsora*. The rust was issued as *Physopella maclurae* in Sydow, Fungi exotici exsiccati no. 785 on the host *Chlorophora tinctoria* (L.) Gaudich. ex Benth. & Hook. f. (Moraceae). Sydow (1930) noticed that the urediniospores of *U. maclurae* were similar to *U. celtidis* collected on *Celtis* spp. in Brazil (Pazschke 1891). As the host families Moraceae and Ulmaceae are closely related, the two rust fungi were compared to investigate their distinctness. Uredinia and urediniospores of the type specimen of *U. celtidis* and another specimen issued in Ule, Mycoth. Brasil. no. 17, were most similar to those of *U. maclurae*. In addition to uredinia, telia were discovered on *U. maclurae* issued by Sydow and on *U. celtidis* issued by Ule. The telia and teliospores of both species resembled each other in every respect, and I therefore consider *U. celtidis* as a synonym of the older name *U. maclurae*.

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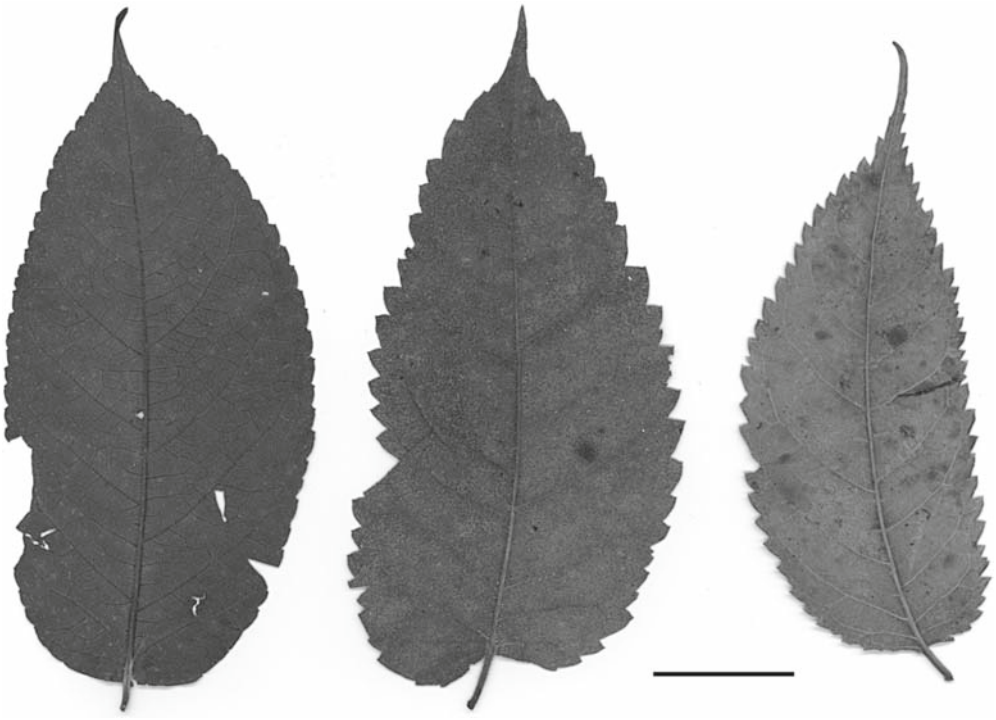

Fig. 1. Host leaves infected with (*left* to *right*) *Uredo celtidis* (type, M-127943), *U. celtidis* (M-128028), and *Chaconia hennenii* (holotype, ZT Myc 213). *Bar* 2 cm

Does *Uredo maclurae* occur on *Maclura* and *Celtis*?

Moraceae is closely related to Ulmaceae, with which they form a monophyletic group together with Cannabaceae and Urticaceae (Stevens 2001 onwards). Because of the kinship of the host families, it is possible that *U. maclurae* occurs on members of both *Maclura* and *Celtis*. To prove this, leaves infected by *U. maclurae* (Fig. 1) were compared with phanerogam specimens of *Maclura* and *Celtis* kept in Z + ZT. It was found that the host leaves assigned to *Celtis* do not represent a member of the latter genus but of *Maclura*, possibly *M. tinctoria*. Thus, *U. maclurae* appears to be restricted to members of *Maclura* of Moraceae.

Affiliation of *Uredo maclurae* with the teleomorph genus *Chaconia*

The observed teliospores (Fig. 2) were one-celled and had delicate walls that were only thickened at the spore apex. They germinated upon maturity from below the apical thickening to form basidia. Although the teliospores morphologically resembled species of the genus *Uromyces*, they were markedly different from the latter genus by the lack of pedicels and their direct formation from sporogenous cells. The uredinia were bounded by peripheral, clavate, and incurved paraphyses (see Fig. 5) that did not derive from a distinct common base (uredinia of *Calidion* type, = *Physopella* type sensu Ono et al. 1992). Teliosporogenesis and the uredinia of *Calidion* type indicate that the rust belongs to Chaconiaceae rather than *Uromyces* (Pucciniaceae) and may be accommodated best within the genus

Fig. 2. Teliospores of *Chaconia hennenii* (holotype, ZT Myc 213), some of them attached to meristematic basal cells. One germinating spore and one with a mature basidium are depicted. *Bar* 20 μm

Chaconia (Ono and Hennen 1983; Cummins and Hiratsuka 2003). *Aplopsora* is very similar to *Chaconia*, but is delimited by basally united uredinial paraphyses and sessile teliospores produced in a single layer (Cummins and Hiratsuka 2003). The morphology of the telia does not seem to differ essentially from *Chaconia*, however.

Chaconia hennenii, the new holomorph species for *Uredo maclurae* and *U. celtidis*

The present rust is unique among the known *Chaconia* species by the conspicuous apical thickening of the teliospores and subapical germination of the basidia (Ono and Hennen 1983). In all other Chaconias the teliospores germinate by a mere elongation of the teliospore apex. *C. maprouneae* (Viégas) Y. Ono & J.F. Hennen, the only other known *Chaconia* sp. on Moraceae, differs by several additional characters from the present rust fungus. No species of *Aplopsora* are known from Moraceae. To my knowledge, the only other rust that has been reported from *Maclura* is *Cerotelium fici* (Cast.) Arthur [Rayss 1951, sub *Physopella fici* (Cast.) Arthur] whose teliospores are produced in basipetal succession (in "chains"). The only other known rust reported from *Celtis* is *Uromyces celtidis* Dietel. According to the description, it has striate teliospores with long pedicels (Dietel 1907).

The present rust fungus is listed in Hennen et al. (2005) as "*Chaconia apicrassa*" from Brazil but has not been published so far (ICBN 2006, Vienna Code, Art. 32 and 37). It is therefore described as *C. hennenii* in honor of the eminent uredinologist Joe F. Hennen.

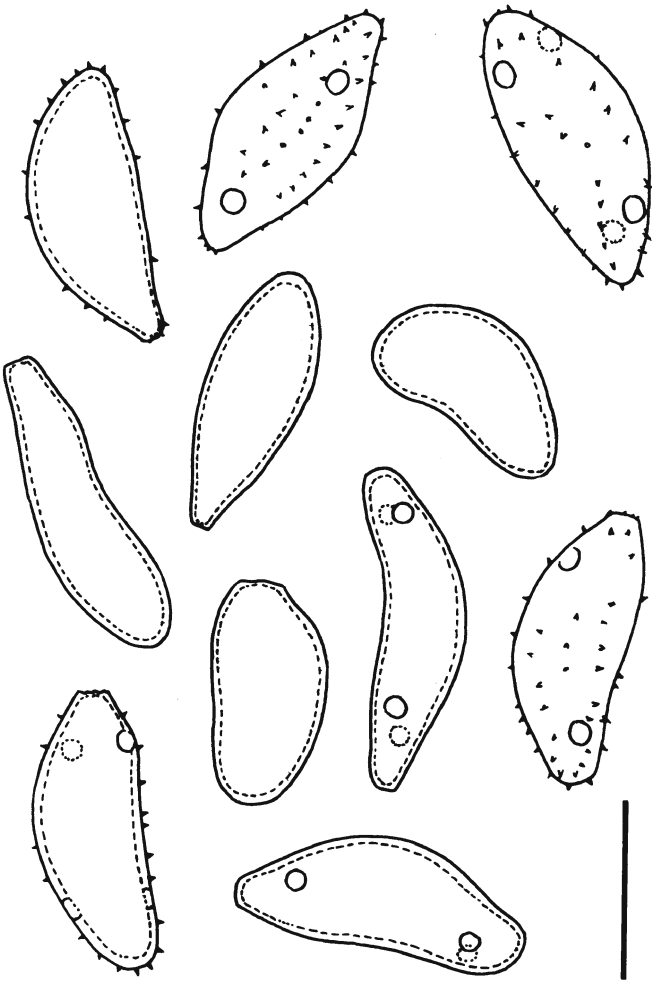

Fig. 3. Urediniospores of *Chaconia hennenii* (holotype, ZT Myc 213). The echinulation and germ pores are only depicted in some of the spores. *Bar* 20 µm

Chaconia hennenii Berndt, sp. nov. Figs. 2–5

MycoBank no.: MB 511620

Anamorph: *Uredo maclurae* Speg. 1884. Ann. Soc. Cient. Argent. 17:122.

≡ *Physopella maclurae* (Speg.) Arthur 1906. Results Bot. Congr. Vienna 1905:338.

= *Uredo celtidis* Pazschke 1891. Hedwigia 30:199.

Uredinia in foliis abaxialia sparsa, subepidermalia, ferruginea, pulverulenta, rotunda, ca. 100–200 µm diametro, paraphysibus brevibus plerumque non vel simplice septatis introrse curvatis clavatis praedita, 20–30 × 8–11 µm, pariete hyalino vel subhyalino dorsaliter incrassato usque ad 3–5 µm. Urediniosporae asymmetricae, aspectu laterali amygdaliformes, subclavatae vel subreniformes, saepe leniter curvatae, 25–39 × 12–16 µm (medium, 31.3 × 14.4 µm), aspectu frontali plus minusve citriformes, subclavatae, ellipsoideae vel subrhomboideae, 25–39 × 14–18 µm, pariete aureo ca. 1 µm crasso in apice ca. 1.5 µm laxe spinibus ca. 0.5–1 µm longis inter se 1.7–3.3 µm distantibus obsitae, poris germinationis 4(–6) plerumque binis in parte superiori et inferiori sporarum locatis epapillatis. Telia subepidermalia, de novo vel ex urediniis obsoletis evolventia, albescentia vel straminea, ceracea, deinde pruinosa basidiis et basidiosporis, paraphysibus ut in urediniis circumdata. Teliosporae sessiles, in cellulis meristematicis basalibus formatae, late ellipsoideae vel subcuneatae, apicaliter rotundatae, subconicae vel subtruncatae, hilum versus attenuatae, 28–45 × 14–20 µm (medium, 37.0 × 17.0 µm), pariete levi hyalino ca. 0.5 µm crasso apicaliter 2–4 µm incrassato, statim germinantes, basidiis externis allantoideis; basidiosporae plus minusve globosae.

In foliis *Maclurae tinctoriae* (L.) D. Don ex Steud. (Moraceae).

Uredinia scattered abaxially on leaves, subepidermal, ferrugineous, pulverulent, rounded, about 100–200 µm diameter, with short, none- or one-septate, inwardly bent club-shaped paraphyses, 20–30 × 8–11 µm, with a hyaline to subhyaline wall, thickened dorsally to 3–5 µm. Urediniospores asymmetrical, in side view almond-shaped, subclavate to subreniform, often slightly bent, in top view more or less lemon-shaped, subclavate, ellipsoid or approximately rhomboidal, in side view 25–39 × 12–16 µm (mean, 31.3 × 14.4 µm), in top view 25–39 × 14–18 µm, spore wall golden-brown, about 1 µm thick, to 1.5 µm at spore apex, sparsely, slightly unevenly and distantly echinulate by spines about 0.5–1 µm long and 1.7–3.3 µm apart, tending to occur

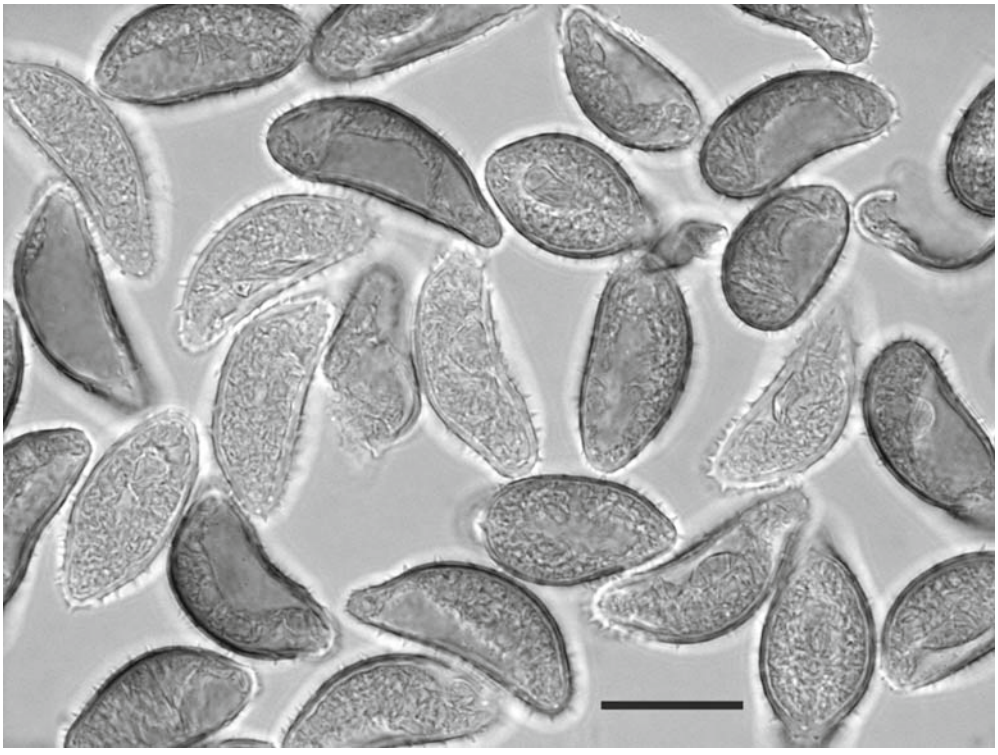

Fig. 4. Micrograph of urediniospores of *Chaconia hennenii* (holotype, ZT Myc 213). *Bar* 20 µm

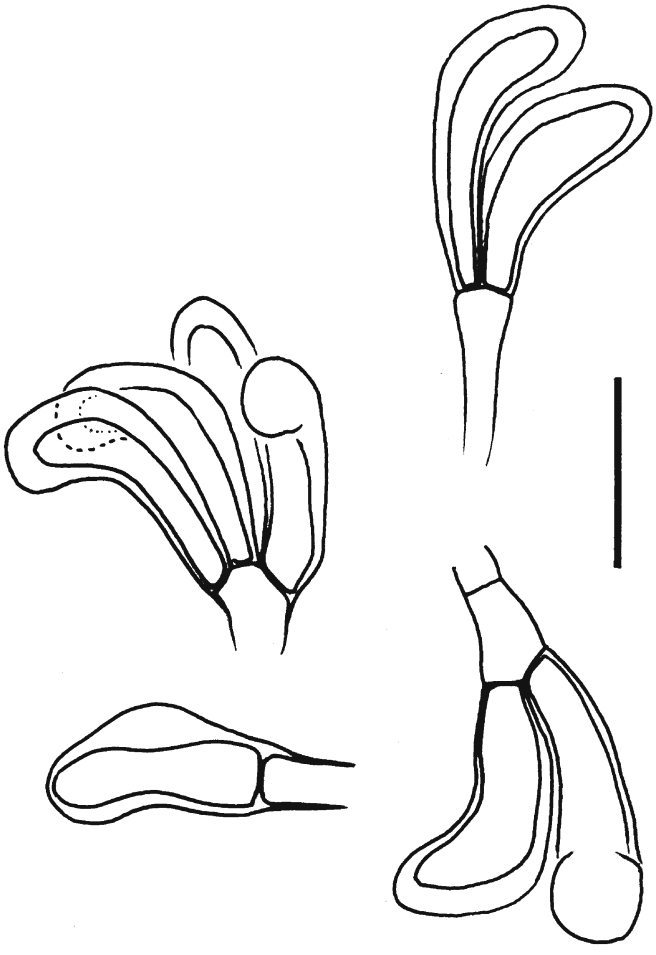

Fig. 5. Paraphyses from uredinia and telia of *Chaconia hennenii* (holotype, ZT Myc 213). *Bar* 20 µm

in lines, germ pores 4(–6), most often located pairwise in the proximal and distal third of the spore where they occupy variable positions, without caps. Telia subepidermal, developing independently or from old uredinia, whitish to straw-colored, first wax-like, later pruinose by germinated basidia and basidiospores, with peripheral paraphyses, paraphyses as in uredinia. Teliospores sessile on meristematic basal cells, broadly ellipsoid, ellipsoid or subcuneate, apically rounded, broadly conical or subtruncate, tapering toward the hilum, 28–45 × 14–20 µm (mean, 37.0 × 17.0 µm), spore wall hyaline, smooth, about 0.5 µm thick, apically with an internal cap-like wall apposition that is 2–4 µm thick and slightly light refracting, germinating upon maturity by allantoid, external basidia emerging from beneath of the apical thickening; basidiospores more or less globose.

On leaves of *Maclura tinctoria* (L.) D. Don ex Steud. (Moraceae).

Holotype (ZT Myc 213): Venezuela, El Limón, near Puerto la Cruz, on leaves of *Chlorophora* (= *Maclura*) *tinctoria*, 14 Jan. 1928, leg. H. Sydow (issued as *Physopella maclurae* Arthur in Sydow, Fungi exotici exsiccati, no. 785) (II, III).

Additional materials studied: *Uredo celtidis*. Brazil, Santa Catharina State, Tubarão, on living leaves of *Maclura* sp. (sub *Celtis* sp.), April 1890, leg. E. Ule, M-127943 (type! II). Brazil, Amazonas, Juruá, on *Maclura* sp. (sub *Celtis* sp.), 1900, leg. E. Ule (Ule, Mycoth. Brasil. no. 17), M-0128028 (II, III).

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