

A contribution to the rust flora (Uredinales) of southern Africa, with an emphasis on Namibia*

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Five new rust species are described and hitherto unknown spore states for the following seven species are reported: *Puccinia desertorum* on *Evolvulus alsinoides*, *Uromyces comptus* on *Merremia bipinnatipartita*, *Puccinia halsei* on *Acacia hereroensis*, *Ravenelia transvaalensis* on *Acacia mellifera*, *Puccinia abutili* on *Abutilon angulatum*, on *Abutilon* cf. *austro-africanum*, and on *Abutilon* cf. *rehmannii*, *Puccinia lycii* on *Lycium* sp. and *Puccinia turgida* on *Lycium europaeum* and on *Lycium* cf. *oxycarpum*. We also examined *Uredo combreticola* on *Combretum* cf. *engleri*, on *Combretum hereroense*, and on *Combretum zeyheri*, *Puccinia afra* on *Lycium* sp., and *Uredopeltis* cf. *chevalieri* on *Grewia flavescens*. All mentioned rust fungi are described in detail and are shown by line drawings. Selected species are illustrated with SEM-photographs.

Taxonomical novelties: *Puccinia namibiana* Mennicken, Maier & Oberw. (Anamorph *Aecidium acanthopsidis* Henn.) on *Blepharis obmitrata*, *Uromyces otaviensis* Mennicken, Maier & Oberw. on cf. *Ipomoea verbascoidea*, *Puccinia windhoekensis* Mennicken, Maier & Oberw. on *Coccinia rehmannii*, *Puccinia ovamboensis* Mennicken, Maier & Oberw. on *Triaspis hypericoides*, and *Uredopeltis flavae* Mennicken, Maier & Oberw. on *Grewia flava*.

Keywords: Biodiversity, rust fungi, South Africa, taxonomy

Until now the rust flora of Namibia has not been examined systematically. As far as could be established only 13 rust species from Namibia have been recorded so far (HENNING 1898; DIETEL in SYDOW & SYDOW 1904; SYDOW & SYDOW 1912b, 1915, 1924; POLE EVANS 1915; SYDOW 1928; DOIDGE 1939, 1950; GJÆRUM 1988). If this number is compared to the circa 4.200 known higher plant species (CRAVEN 1999) it is clear that many more rust species await to be found: for example, Austria has 491 rust species (ZWETKO 2000) and about 3.300 higher plant taxa (ADLER et al. 1994), corresponding to a ratio of circa 15 %, thus, reinforcing the observations of HENNEN & MCCAIN (1993) that rust species are about 5–25 % as numerous as plant species. As a consequence, a total rust flora between 200 to 1.000 species could be expected for Namibia.

A first approach to complete the Namibian rust flora was made during the pilot phase of the BIOTA (Biodiversity Monitoring Transect Analyses) Southern Africa project: rust fungi were collected extensively in Namibia and in the western parts of South Africa. In the present study we report observations

made predominantly in Namibia with superior taxonomic interest like new rust species, new spore states of known rust fungi and records of species from which until now only the type collections were known. The complete species list from Namibia with more than 60 species will be soon published as ‘Preliminary flora of rust fungi in Namibia’ in the Namibian botanical journal ‘Dinteria’.

Material and methods

Most of the specimens were collected in Namibia by the first author between 1 March 2002 and 3 May 2002. The specimens collected in the course of this study as well as some additional specimens from herbaria were studied from freehand sections and scrape mounts of infected plant material. The samples were heated in ‘Hoyer’s fluid’ (CUNNINGHAM 1972) and subsequently examined with a Carl Zeiss microscope with bright field and phase contrast optics. For scanning electron microscopy, air-dried fragments of rust-infected leaves were put onto double-sided adhesive tape fixed to an observation stub, spattered with gold-palladium and observed with a Cambridge Stereoscan 250 Mk-2.

With the exception of pycnio- and basidiospores, 25 spores of each occurring spore states were measured. If only one collection of a rust species was available or in the case of type collections 50 spores of each present spore state were measured. If a spore state is put in parentheses, measurements were

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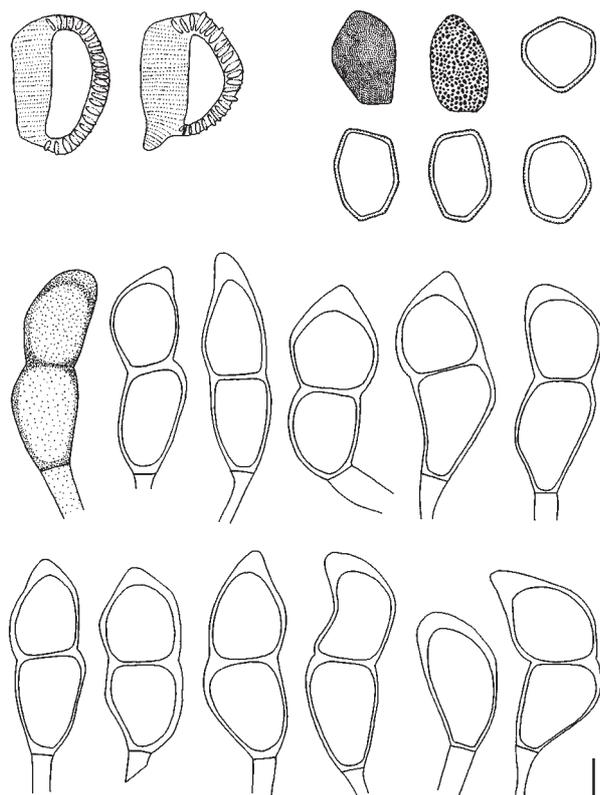


Fig. 1: *Puccinia namibiana* on *Blepharis obmitrata*. Peridium cells, acio- and teliospores (Holotype NA 216). Scale bar = 10 μm .

not available; the reasons for that are either that there were too small a number of spores or that there were strong alterations of spores which had already germinated.

Peridium cells are presented with the outer wall of the cells on the left hand side of the line drawing, and the inner wall on the right hand side. All specifications with the prefix 'circa' are based on measurements of less than 25 cells.

The morphological types of anamorphic states follow CUMMINS & HIRATSUKA (2003).

The terms to describe the teliospores of the genus *Ravenelia* follow HERNÁNDEZ & HENNEN (2002). They "consider the 'spore head' to be a single teliospore composed of many pigmented probasidial cells. Hyaline, hygroscopic cysts occur on the abaxial surface of the teliospore and sterile intercalary cells are sometimes present between the probasidial cells and the cysts." The description of the shape of the teliospores, like 'convex above, even below', is restricted to the pigmented probasidial cells.

For the determination of the rust fungi the encyclopaedic publications of DOIDGE (1927, 1928, 1939, 1941, 1948a, 1948b, 1950) were the main source of information. In addition, we checked many other publications concerning the rust flora of Africa, which are available via internet under <http://www.mycology.uni-tuebingen.de/databases/rust-literature/>.

Results and discussion

The rust species are listed in alphabetical order referring to the host family and the host genus, respectively. The following abbreviations are used: 0 = pycnia = spermogonia; I = aecia; II = uredinia; III = telia, IV = basidia.

Acanthaceae – *Blepharis*

Puccinia namibiana Mennicken, Maier & Oberw. sp. nov.

Fig. 1

Anamorph. *Aecidium acanthopsidis* Syd. & P. Syd. (SYDOW & SYDOW 1915: 36). Type on cf. *Blepharis obmitrata* C.B. Clarke (as *Acanthopsis* sp. juv.). Namibia, Okahandja, 10. 2. 1911, leg. Kurt Dinter No. 2530 (B 70 0007226).

Pycnia rara, amphigena in foliis, tipo 4. Aecia aecidioidea, amphigena, laxe aggregata. Cupulae conicae, usque ad 600 μm longae, circa 300–400 μm diam. Peridia cremeo-alba, recurvata, irregulariter lacerata, cellulis peridii firme conjunctis, pariete exteriori striato, circa 9–13 μm crasso, pariete interiore verruculoso, circa 3–5 μm crasso. Aeciosporae angulato-globoideae vel ellipsoideae, 17–24 (26) \times 13–19 μm , pariete irregulariter verruculoso, hyalino, 0.5–1.5 μm crasso. Uredinia ignota. Telia amphigena, subepidermalia, atro-brunnea vel nigra, usque ad 4 mm diam., epidermide tecta, loculata paraphysibus castaneis. Teliosporae bicellulares, cylindratae, clavatae vel fusiformes, apice obtuso vel subacuminato, base attenuata, medio leviter constrictae, (38) 43–61 (67) \times 13–20 (23) μm , pariete laevigato, lateraliter 1–2 μm crasso, apicaliter 4–8 μm crasso, pedicello fusco vel brunneo, usque ad 95 μm longo. Mesosporae et teleosporae tricellulares adsunt.

In foliis *Blepharidis obmitratae* (Acanthaceae).

Pycnia rarely present, amphigenous on leaves, subepidermal, type 4.

Aecia *Aecidium*-type, amphigenous on leaves, densely scattered in roundish or irregular groups up to 4 mm diameter on slightly brightened spots, which tend to be hypertrophy in the range of leaf veins, groups separate or admixed with the telia, aecial cups conical, long remaining closed, erumpent, circa 300–400 μm diameter, up to 600 μm tall, spore mass yellowish-white or creamish-white, surrounded by finely recurved, irregularly lacerated, creamish-white peridium, cells of the peridium firmly connected, outer wall finely striate, circa 9–13 μm , inner wall verrucous, circa 3–5 μm . Aeciospores angular globoid to ellipsoid, 17–24 (26) \times 13–19 μm , verrucous, warts irregularly developed, from delicate and even to coarse and irregular, spore wall 0.5–1.5 μm , hyaline, germ pores inconspicuous.

Uredinia unknown.

Telia amphigenous on leaves, subepidermal, dark chocolate-brown to blackish pustules up to 4 mm, roundish or irregular in outline, separate or admixed with the aecia, covered by the epidermis, clearly margined on the host leaves, strongly loculate with chestnut-brown, thin paraphyses, interspaces up to 120 μm wide and circa 160 μm high, small yellowish-brown spots surrounding the telia, not clearly margined on the host

leaves. Teliospores in general bicellular, cylindrical, clavate, or \pm fusiforme, obtuse or subacuminate at the apex, attenuate at the base, slightly constricted at the septum, (38) 43–61 (67) \times 13–20 (23) μm , wall smooth, yellowish-brown, about 1–2 μm at the sides, about 4–8 μm thick at the apex, germ pores obscure, pedicel up to 95 μm long, persistent, partly collapsing, yellowish-brown. Mesospores and tricellular spores existing.

On the leaves of *Blepharis obmitrata* (Acanthaceae).

Etymology. Named after the country of occurrence, Namibia.

Specimens examined:

On *Blepharis obmitrata*. Namibia, B 2 Okahandja - Wilhelmstal, 21°56'44.6''S, 16°43'18.5''E, 1.484 m asl., 6. 4. 2002, leg. M. Mennicken No. NA 216, I III. Holotype (PREM), Isotype (WIND). – On cf. *Blepharis obmitrata*. Namibia, Oshikoto, D 3031, C 39 - Lake Guinas, 19°25'45.2''S, 17°24'16.8''E, 1.362 m asl., 10. 4. 2002, leg. M. Mennicken No. NA 241, I III. Paratypes (PREM, WIND). – On cf. *Blepharis obmitrata* (as *Acanthopsis* sp. juv.). Namibia, Okahandja, Akazienbuschsteppe, 10. 2. 1911, leg. Kurt Dinter No. 2530, I. Type of *Aecidium acanthopsidis* (B 70 0007226). – On *Blepharis obmitrata*. Namibia, B 2 Karibib - 100 - Okahandja, 21°57'22.4''S, 15°57'31.5''E, 1.319 m asl., 6. 4. 2002, leg. M. Mennicken No. NA 144, 0 I. (PREM, WIND). – On *Blepharis obmitrata*. Namibia, Windhoek, Love Street, 22°33'48.9''S, 17°05'16.8''E, 1.736 m asl., 5. 4. 2002, leg. M. Mennicken No. NA 161, 0 I. (PREM, WIND).

After LAUNDON (1963a) the aecia differ from all other rust fungi on Acanthaceae in having peridial cells with very thick outer walls.

Combretaceae – *Combretum*

Uredo combreticola Doidge (DOIDGE 1939: 506). **Fig. 2**

Type on *Combretum zeyheri* Sond. South Africa, Transvaal, Barberton, Nelspruit, Research Station, 11. 9. 1931, leg. Liebenberg No. 2777 (PREM 26038).

Pycnia, aecia, and telia unknown.

Uredinia *Uredo*-type, amphigenous on leaves, subepidermal, scattered, occasionally covering the whole leaf surface, irregularly rupturing pustules up to 0.5 mm diameter, generally smaller, not clearly margined on the host leaves, roundish or irregular in outline, elongated in a tip, brown, powdered by the pale brownish urediniospores, spots surrounding pustules inconspicuous, slightly brightened, not clearly margined on the host leaves, with an undefined layer of presumably fungal cells between epidermis and urediniospores. Paraphyse-like structures hyaline, short, uniformly thin-walled. Urediniospores borne singly on pedicels, subglobose, ovoid to elliptic, 15–25 (29) \times 13–21 μm , spore wall uniformly about 1–1.5 (2) μm wide, pale golden to hyaline, echinulate, germ pores rather obscure, occasionally indicated in optical sections, probably numerous and scattered, without papillae.

Specimens examined:

On *Combretum zeyheri* Sond. South Africa, Transvaal, Barberton, Nelspruit, Research Station, 11. 9. 1931, leg. Liebenberg No. 2777,

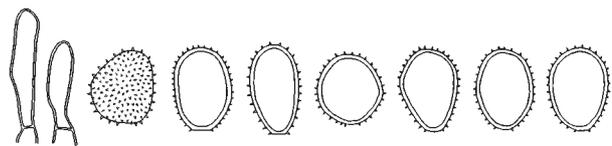


Fig. 2: *Uredo combreticola* on *Combretum hereroense*. Paraphyse-like structures and urediniospores (NA 256). Scale bar = 10 μm .

II. Type (PREM 26038). – On *Combretum* cf. *engleri* Schinz. Namibia, Koukuas, 18°54'16.7''S, 18°17'14.6''E, 1.197 m asl., 14. 4. 2002, leg. M. Mennicken No. NA 265, II. (PREM, WIND). – On *Combretum hereroense* Schinz. Namibia, D 3001, B 1 - Tsintsabis, 18°43'55.1''S, 17°34'54.1''E, 1.167 m asl., 13. 4. 2002, leg. M. Mennicken No. NA 256, II. (PREM, WIND). – On *Combretum hereroense*. Namibia, D 2860, B 8 - Hoba Meteorite, 19°37'43.7''S, 17°56'39.0''E, 1.518 m asl., 16. 4. 2002, leg. M. Mennicken No. NA 289, II. (PREM, WIND).

CROUS et al. (2000) have not cited this rust for South Africa. *Uredo combreticola* is new to the rust flora of Namibia, *Combretum hereroense* and *Combretum* cf. *engleri* seem to be new host plants.

Before examining the type collection we were in doubt about our collections belonging to *Uredo combreticola*, because DOIDGE (1939) stated thinner urediniospores (17–23 \times 10–15 μm) with verrucous spore walls, and did not mention paraphyses. Our collections conform well with the type collection. It could not be determined whether the uniformly thin-walled 'paraphyse-like structures' are paraphyses or deformed pedicels after losing the urediniospores.

Following three other species of rust fungi are known with urediniospores on *Combretum* species:

Uredo longaensis Henn. (HENNING 1903), which is described on *Combretum baumii* Engl. & Gilg. in Angola. It differs in having catenulate urediniospores with apically thickened spore walls (VIENNOT-BOURGIN 1958).

Cerotelium combreti Cummins (CUMMINS 1952) is described on *Combretum* sp. from Uganda and differs in having paraphyses with externally thickened walls.

Uredo combreti F. Kern & Thurst. (KERN & THURSTON 1944) on *Combretum fruticosum* (Loefl.) Stuntz from Venezuela has much bigger urediniospores (18–23 \times 26–35 μm).

Convolvulaceae - *Evolvulus*

Puccinia desertorum Syd. & P. Syd. (SYDOW & SYDOW 1911: 259). **Fig. 3**

Type on *Evolvulus alsinoides* (L.) L. Namibia, Okahandja, 1.200 m asl., 26. 5. 1907, leg. Kurt Dinter No. 570 (B 70 0007270).

Pycnia rarely developed, adaxial on leaves, opposite to or admixed with the aecia, type 4.

Aecia *Aecidium*-type, amphigenous on leaves, densely scattered in small and roundish, partially confluent, groups up to 3 mm diameter on slightly brightened and yellowed leaf spots,

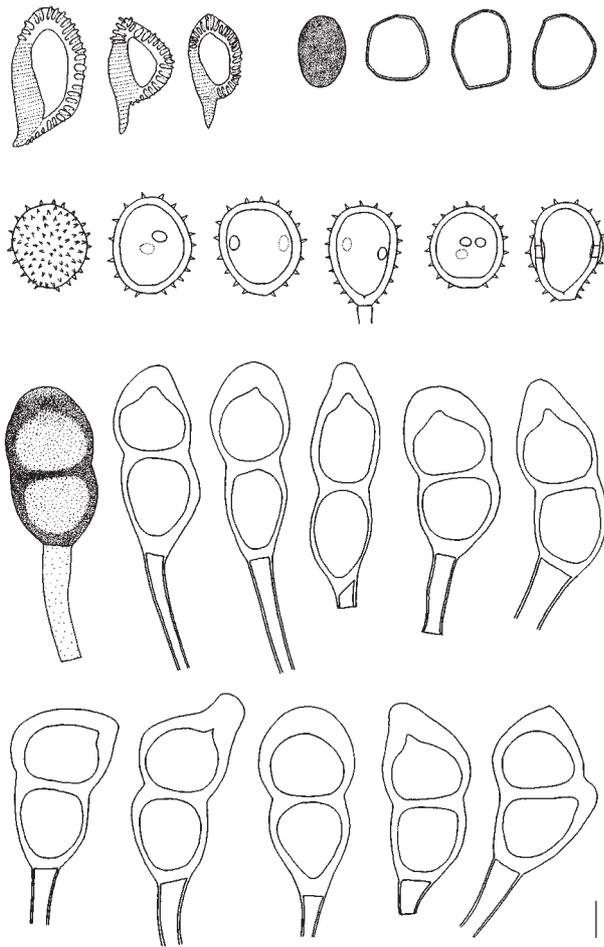


Fig. 3: *Puccinia desertorum* on *Evolvulus alsinoides*. Peridium cells and aeciospores (NA 172), uredinio- and teliospores (NA 276). Scale bar = 10 μ m.

groups often admixed with the uredinia, aecial cups small conical to cylindrical, erumpent, circa 100–200 μ m diameter, up to circa 300 μ m tall, spore mass yellowish-white or white, surrounded by recurved, irregularly lacerated, whitish peridium, cells of the peridium firmly connected, outer wall finely striate, 3–8 μ m, inner wall verrucous, 3–5 μ m. Aeciospores angular globoid to ellipsoid, 15–21 \times 12–19 μ m, delicately verrucous, spore wall uniformly 0.5–1 μ m, hyaline, germ pores inconspicuous.

Uredinia *Uredo*-type, amphigenous on leaves, rarely caulicolous, subepidermal, small pustules, \pm roundish, up to 0.5 mm wide, separate, scattered, or in irregular or concentric groups, cinnamon-brown, exposed and surrounded by the torn epidermis. Spots surrounding partially the uredinia up to 2 mm wide, yellow, brown to pale yellowish-green, not clearly margined on the host leaves. The whole leaves are yellowing, later browning in the case of heavy infection. Urediniospores obovoid, subglobose to ellipsoid, 19–28 \times 15–23 μ m, echinulate, spore wall uniformly about (1) 1.5–2.5(3) μ m thick, yellowish-brown, germ pores conspicuous, 2 (to 3), equatorial, with medium developed hyaline papillae.

Telia amphigenous on leaves, rarely caulicolous, subepidermal, small pustules up to 0.5 mm, roundish or irregular in outline, separate, scattered, or in irregular or concentric groups, partially replacing the uredinia, black, exposed and surrounded by the torn epidermis. Spots surrounding partially the telia up to 2 mm wide, yellow to pale yellowish-green, not clearly margined on the host leaves. Teliospores bicellular, ellipsoid, clavate to oblong, flattened, rounded or acuminate at the apex, attenuate to subattenuate at the base, medium constricted at the septum, 38–54 (56) \times 18–25 μ m, spore wall smooth, about 1–2.5 μ m thick at the sides, up to 13 (15) μ m thick at the apex, brown, apical brightened, germ pores apical and just below the septum, pedicel up to 55 μ m, thick-walled, not collapsing in fresh material, yellowish to hyaline.

Specimens examined:

On *Evolvulus alsinoides*. Namibia, Okahandja, 1.200 m asl., 26. 5. 1907, leg. Kurt Dinter No. 570, II III. Type (B 70 0007270). – On *Evolvulus alsinoides*. Namibia, BIOTA-observatory at Sonop 903 Research Station, 19°04'51.9''S, 18°54'47.4''E, 5. 3. 2002, leg. M. Mennicken No. NA 119, II. (PREM, WIND). – On *Evolvulus alsinoides*. Namibia, D 3016, 18°51'22.5''S, 18°28'49.2''E, 1.204 m asl., 25. 4. 2002, leg. M. Mennicken No. NA 276, II III. (PREM, WIND). – On *Evolvulus alsinoides*. Namibia, Ombeameiata, house camp, 21°25'50.1''S, 18°01'22.6''E, 1.606 m asl., 2. 4. 2002, leg. M. Mennicken No. NA 185, 0 II. (PREM, WIND). – On *Evolvulus alsinoides*. Namibia, Steinhäuser, camp WNM of the farmhouse, 21°48'50.3''S, 18°13'07.1''E, 1.661 m asl., 1. 4. 2002, leg. M. Mennicken No. NA 172, 0 I II III. (PREM, WIND). – On *Evolvulus alsinoides*. Namibia, Windhoek, water tower mountain, 22°33'58.2''S, 17°05'39.5''E, 1.759 m asl., 5. 4. 2002, leg. M. Mennicken No. NA 157, II. (PREM, WIND).

Puccinia desertorum seems to be only known from the Namibian type collection, from Madras, India (RAMAKRISHNAN et al. 1953), and from Kenya (GJÆRUM 1986). Until now only uredinia and telia have been found. Therefore, pycnia and aecia of *Puccinia desertorum* are described as new.

Convolvulaceae – *Ipomoea*

Uromyces otaviensis Mennicken, Maier & Oberw. sp. nov. **Figs. 4 (Plate 1), 5**

Pycnia et uredinia ignota. Aecia aecidioida, amphigena, cupulata. Cupulae circa 150–550 μ m diam., usque ad 750 μ m altae. Peridia alba, recurvata, irregulariter lacerata, cellulis peridii firme conjuncta, pariete exteriori laevi, circa 4–8 μ m crasso, pariete interiore verruculoso, circa 8–12 μ m crasso. Aeciosporae angulatae globoideae vel ellipsoideae, 23–34 \times 17–27 μ m, pariete verruculoso, hyalino, 1.5–3 μ m crasso. Telia amphigena, subepidermalia, nigra, mox nuda, pulverulenta. Teliosporae unicellulares, dimorphae, juniores applanato-globoideae, castaneae, 21–29 \times 27–33 μ m, vetustiores pileatae, atro-castaneae vel nigrae, 14–18 \times 24–28 μ m, pariete irregulariter corrugato, lateraliter 2–3.5 μ m crasso, apicaliter usque ad 10 μ m crasso, bilaminato, vetustiorum sporarum strato exteriori inconspicuo, pedicello hyalino, usque ad 50 μ m longo, inflato.

In foliis cf. *Ipomoeae verbascoideae* Choisy (Convolvulaceae).

Pycnia unknown.

Aecia *Aecidium*-type, amphigenous on leaves, subepidermal, scattered in small and roundish, partly confluent groups up to

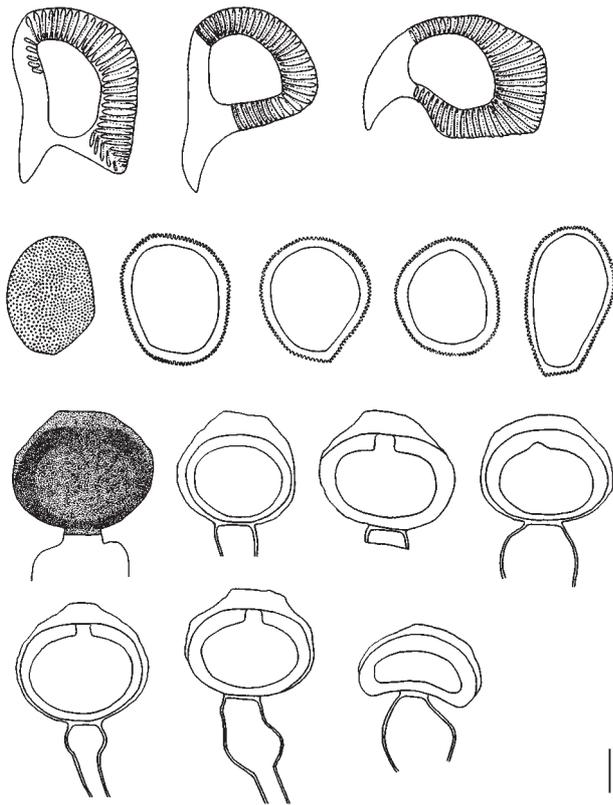


Fig. 5. *Uromyces otaviensis* on cf. *Ipomoea verbascoidea*. Peridium cells, aecio- and teliospores (Holotype NA 305). Scale bar = 10 μ m.

3 mm diameter, on slightly brightened and yellowed leaf spots, groups often admixed with the telia, aecial cups erumpent, circa 150–550 μ m diameter, up to circa 700 μ m tall, spore mass yellowish-white or white, surrounded by recurved, irregularly lacerated, whitish peridium, cells of the peridium firmly connected, outer wall smooth, circa 4–8 μ m thick, inner wall verrucous, circa 8–12 μ m thick. Aeciospores angular globoid to ellipsoid, 23–34 \times 17–27 μ m, regularly verrucous, spore wall 1.5–3 μ m, hyaline, germ pores inconspicuous.

Uredinia and urediniospores unknown.

Telia amphigenous on leaves, subepidermal, forming small patches up to 1 mm wide, exposed, pulverulent, roundish, separate or scattered, often associated with the aecia, black, spots surrounding the telia up to 2 mm wide, yellow to yellowish-green, not clearly margined on the host leaves. Teliospores unicellular, tending to be dimorphic depending on maturity, younger spores flattened globoid, chestnut-brown, 21–29 \times 27–33 μ m, full-grown spores collapsed on the bottom side and pileolus-shaped, 14–18 \times 24–28 μ m, dark chestnut-brown to blackish, spore wall bilaminate, about 2–3.5 μ m thick at the sides, up to 10 μ m thick at the apex, outer layer irregularly wrinkled, forming a broad and flattened papilla over the apical germ pore, in young spores recognisable as a separate layer and swellable in heated lactic acid up to 1–3 μ m, golden, in

full-grown spores not or uncontinuous recognisable as a separate layer and not swellable, dark chestnut-brown to blackish, inner layer chestnut-brown to blackish, probably smooth, continuously thickened from the base to the apex, pedicel up to 50 μ m long, not collapsing, usually with spherical swelling short below the attachment, hyaline.

On the leaves of cf. *Ipomoea verbascoidea* (Convolvulaceae). Etymology. Named after the habitat in Namibia, Otavi Mountains.

Specimen examined:

On cf. *Ipomoea verbascoidea*. Namibia, Otavi Mountains, D 2863, 19°33'30.1''S, 17°44'37.6''E, 1.757 m asl., 17. 4. 2002, leg. M. Mennicken No. NA 305, I III. Holotype (PREM), Isotype (WIND).

A similar rust fungus *Uromyces ipomoeae* (Thüm.) Berk. was found on three *Ipomoea* species in Eastern Cape, Mpumalanga, and North-West Province in South Africa (CROUS et al. 2000). It differs from *Uromyces otaviensis* in having an “epispore ... with regular longitudinal striae which radiate from the apex and converge towards the base” as well as in having smaller (20–25 μ m), and thinner-walled (about 1 μ m thick) aeciospores (DOIDGE 1927).

Uromyces pieningii Cummins (CUMMINS, 1960: 45), which is described on *Ipomoea argentea* Hall. f. from Ghana, differs from *Uromyces otaviensis* mainly in having thin-walled peridial cells (inner wall 3 μ m thick, outer wall 3–4 μ m thick) and in having smaller (23–27 \times 15–20 μ m), thin-walled (1 μ m) aeciospores.

Convolvulaceae – *Merremia*

Uromyces comptus Syd. & P. Syd. (SYDOW & SYDOW 1911: 259).

Fig. 6

Type on *Merremia bipinnatipartita* (Engl.) Hallier f. (= *Ipomoea bipinnatipartita* Engl.) Namibia, Okahandja, Wilhelmstal, 1.300 m asl., 19. 5. 1907, leg. Kurt Dinter No. 562. (B 70 0007272).

Pycnia (type 4) admixed with aecia.

Aecia *Aecidium*-type, abaxial on leaves, beginning in the area of veins, causing slightly hypertrophy deformity, densely scattered in longitudinal groups up to 1.5 cm, aecial cups cylindrical, erumpent, circa 200–300 μ m diameter, up to 500 μ m tall, spore mass white, surrounded by recurved, irregularly and deeply lacerated, white peridium, cells of the peridium loosely connected, outer wall smooth, 2–3 μ m, inner wall coarsely verrucous, 3–5 μ m. Aeciospores angular subgloboid, ovoid to ellipsoid, 18–25 \times 15–21 μ m, delicately verrucous, spore wall 0.5–1.5 μ m, hyaline, germ pores inconspicuous.

Uredinia *Uredo*-type, amphigenous on leaves, separate or scattered, subepidermal, irregularly rupturing pustules small, up to 0.8 mm wide, roundish, cinnamon-brown, early exposed, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules. Urediniospores globoid, ovoid, or ellipsoid, partly angular, 22–32 \times 18–24 μ m, echinulate, spore wall uniformly 1.5–2.5 μ m thick, brown, germ

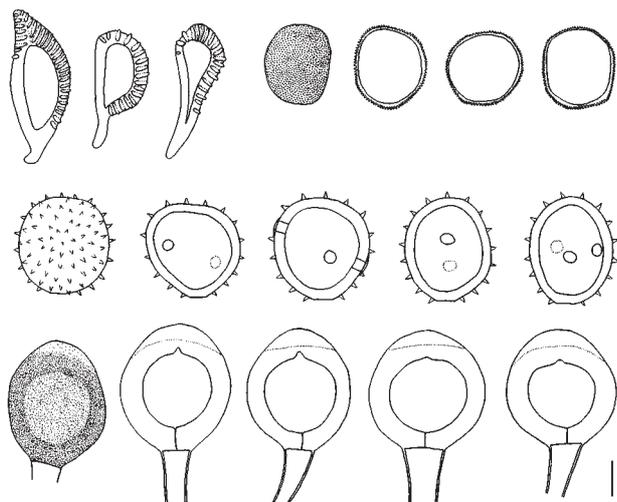


Fig. 6: *Uromyces comptus* on *Merremia bipinnatipartita*. Peridium cells, acio-, uredinio-, and teliospores (NA 221). Scale bar = 10 μ m.

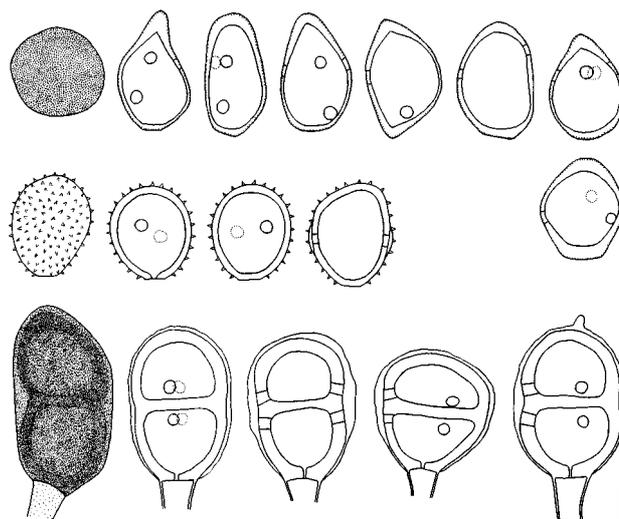


Fig. 8: *Puccinia windhoekensis* on *Coccinia rehmannii*. Peridium cells, acio-, uredinio-, and teliospores (Holotype NA 152). Scale bar = 10 μ m.

pores conspicuous, 2 to 3, \pm equatorial, papillae very weakly developed.

Telia amphigenous on leaves, developing from the uredinia, separate or scattered, subepidermal, irregularly rupturing pustules small, up to 0.8 mm wide, pulvinate, roundish, black, early exposed, surrounded by the torn epidermis, without spots surrounding pustules. Teliospores unicellular, globoid to ovoid, chestnut-brown, 28–38 \times 25–30 μ m, spore wall smooth, about 4–6 μ m thick at the sides, up to 12 μ m thick at the apex, germ pore apical, with a broad brownish-yellow papilla, pedicel up to 120 μ m long, thick-walled, not collapsing, hyaline.

Specimens examined:

On *Merremia bipinnatipartita*. Namibia, Okahandja, Wilhelmstal, auf Lateritflächen, 1.300 m asl., 19. 5. 1907, leg. Kurt Dinter No. 562, II III. Type (B 70 0007272). – On *Merremia bipinnatipartita*. Namibia, C 36 Wilhelmstal - Omaruru, behind D 2110, 21°34'44.9''S, 16°08'00.0''E, 1.314 m asl., 6. 4. 2002, leg. M. Mennicken No. NA 221, 0 I II III. (PREM, WIND).

In the Namibian type collection of *Uromyces comptus* only uredinia and telia could be found. The only other record of *Uromyces comptus* is known from the same host plant from Tanzania (WATSON 1971): “Dark-brown to black rust pustules on leaves of *Ipomoea bipinnati-partita*”. Therefore, pycnia and aecia are newly described here.

CUCURBITACEAE – COCCINIA

Puccinia windhoekensis Mennicken, Maier & Oberw. sp. nov. **Figs. 7 (Plate 1), 8**

Pycnia rara, amphigena, typo 4. Aecia caeomatoidea, in foliis amphigena vel caulem deformantia, late aggregata, circa 0.3–0.8 mm diam., sine peridia, ochracea, pulverulenta. Aeciosporae catenulatae, subgloboideae, ovoideae, ellipsoideae, oblongae vel pyriformes, par-

tim angulatae, 21–36 \times 17–27 μ m, pariete verruculoso, lateraliter 1–1.5 μ m crasso, apicaliter 2–6 (8) μ m crasso, hyalino, 2–4 (5) poris germinationis dispersis. Uredinia caulicola vel in foliis amphigena, subepidermalia, usque ad 1 mm diam., cinnamomea, mox nuda, pulverulenta. Urediniosporae globoideae, ovoideae vel subellipsoideae, 23–35 \times 17–24 μ m, pariete echinulato, lateraliter 1–2 μ m crasso, apicaliter 1.5–2 (2.5) μ m crasso, castaneo, 2 poris germinationis aequatorialibus. Telia caulicola vel in foliis amphigena, subepidermalia, atro-brunnea vel nigra, usque ad 1 mm diam., mox nuda, pulverulenta. Teliosporae bicellulares, subgloboideae, ovoideae vel ellipsoideae, cylindratae, subclavatae vel irregulares, apice rotundato, applanato vel mucronato, base rotundata vel leviter attenuata, medio haud vel leviter constrictae, 35–48 \times 26–36 μ m, pariete irregulariter corrugato vel rugoso, lateraliter 3–7 μ m crasso, apicaliter 3 to 10 μ m crasso (apiculo incl.), bilaminato, strato exteriori aureo-fulvo, strato interiore atro-castaneo, poris germinationis in quaque cellula 2, juxta septum positus, pedicello aureo vel hyalino, usque ad 85 μ m longo. Mesosporae adsunt.

In foliis caulisque *Coccinae rehmannii* Cogn. (Cucurbitaceae).

Pycnia rarely present, amphigenous on leaves, subepidermal, type 4.

Aecia *Caeoma*-type, caulicolous, causing slight hypertrophy of the stem similar to witches' brooms, amphigenous on leaves, subepidermal, widely scattered in groups, groups about a few millimetres to several centimetres wide, without surrounding leaf spots, erumpent, without peridium, circa 0.3–0.8 mm diameter, roundish to ellipsoid, spore mass ochraceous, pulverulent, surrounded by the convex epidermis, partly admixed with uredinia and telia. Aeciospores catenulate, variable in shape, subgloboid, ovoid, ellipsoid, oblong, pear- or lemon-shaped, partly angular, 21–36 \times 17–27 μ m, delicately verrucous, spore wall variably thick, about 1–1.5 μ m thick at the sides, about 2–6 (8) μ m thick at the apex, about 1.5–3 μ m thick at the base, hyaline, germ pores inconspicuous, 2 to 4 (to 5), scattered.

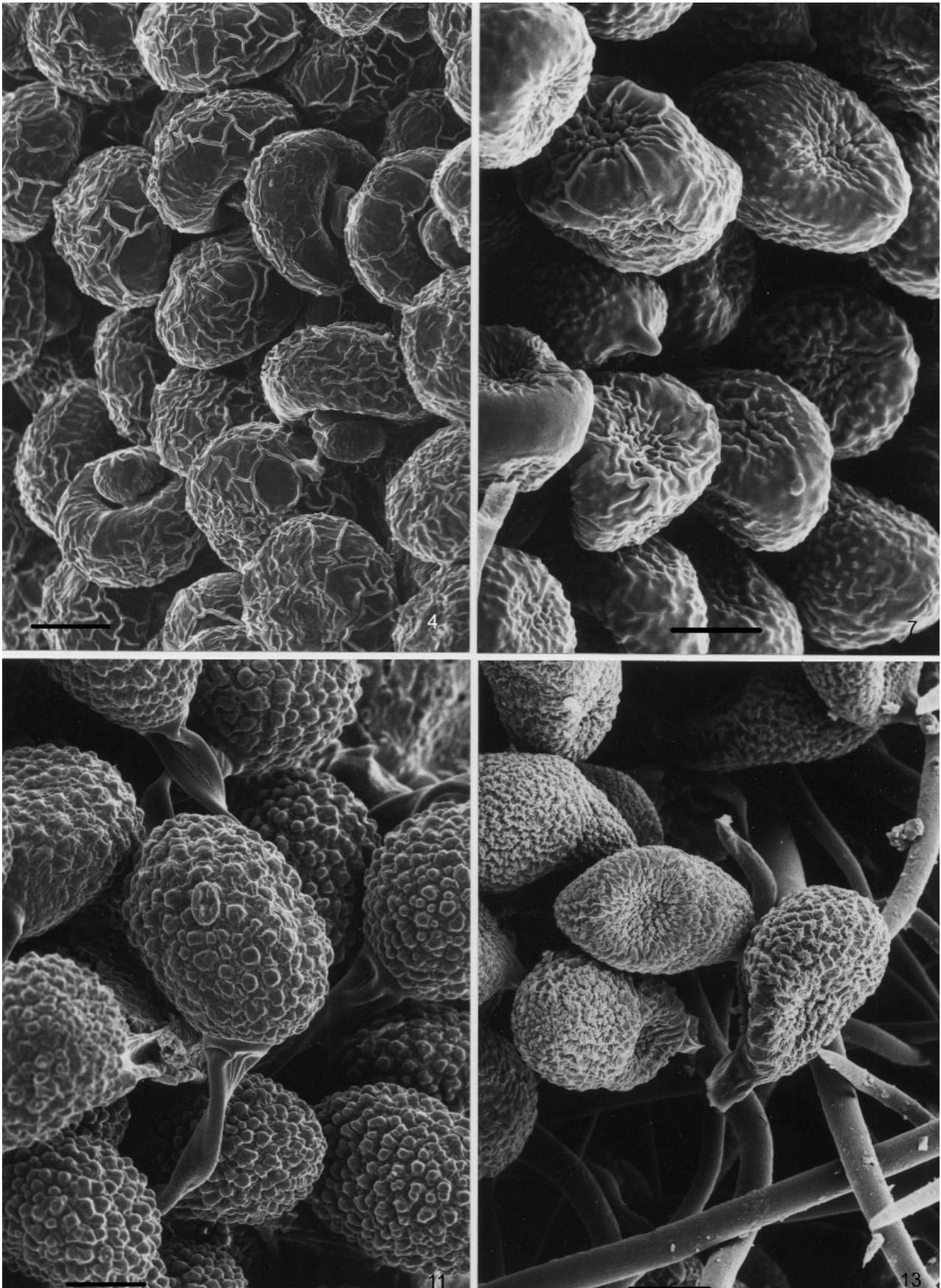


Plate 1. Fig. 4. *Uromyces otaviensis* on cf. *Ipomoea verbascoidea*. Teliospores (Holotype NA 305). SEM. Scale bar = 10 μ m. **Fig. 7.** *Puccinia windhoekensis* on *Coccinia rehmannii*. Teliospores (Holotype NA 152). SEM. Scale bar = 10 μ m. **Fig. 11.** *Puccinia ovamboensis* on *Triaspis hypericoides* ssp. *nelsonii*. Teliospores (Holotype NA 292). SEM. Scale bar = 10 μ m. **Fig. 13.** *Puccinia abutili* on *Abutilon* cf. *austro-africanum*. Teliospores (NA 195). SEM. Scale bar = 10 μ m.

Uredinia *Uredo*-type, caulicolous or amphigenous on leaves, separate, scattered, and in irregular or \pm concentric groups, subepidermal, irregularly rupturing pustules small, about 0.1–1 mm wide, roundish, cinnamon-brown, early exposed, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules, partly admixed with aecia and telia. Urediniospores borne singly on pedicels, globoid, ovoid, or sub-ellipsoid, 23–35 \times 17–24 μ m, finely echinulate, spore wall about 1–2 μ m thick at the sides and about 1.5–2 (2.5) μ m thick at the apex, medium chestnut-brown, basally paler, germ pores conspicuous, 2, equatorial, with hyaline papillae that are weakly developed.

Telia caulicolous or amphigenous on leaves, (partly) developing from the uredinia, separate, scattered, and in irregular or \pm concentric groups, partly confluent, subepidermal, irregularly rupturing pustules small, about 0.1–1 mm wide, roundish, ellipsoid, oblong or irregular in outline, dark chocolate-brown to black, early exposed, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules, partly admixed with aecia and uredinia. Teliospores in general bicellular, sub-globoid, ovoid to ellipsoid, rounded, flattened, or apiculate through an apicule at the apex, rounded or slightly attenuate at the base, not or very slightly constricted at the septum, chestnut-brown, 35–48 \times 26–36 μ m, spore wall about 3–7 μ m thick at the sides, about 3–10 μ m thick at the apex (with apicule), bilaminar, outer layer thin, golden-brown, irregularly corrugated-wrinkled, forming a broad and flattened papilla over the lateral germ pores, inner layer thick, dark chestnut-brown, probably smooth, 2 germ pores per cell short above and below the septum, inconspicuous, pedicel up to 85 μ m long, thick-walled, generally not collapsing, yellowish to hyaline. Mesospores rarely existing.

On the leaves of *Coccinia rehmannii* (Cucurbitaceae).

Etymology. Named after the habitat, the capital city of Namibia, Windhoek.

Specimens examined:

On *Coccinia rehmannii*. Namibia, Windhoek, Sinclairstreet, 22°33'38.9''S, 17°05'19.6''E, 1.731 m asl., 5. 4. 2002, leg. M. Mennicken No. NA 152, 0 I II III. Holotype (PREM), Isotype (WIND). – On *Coccinia rehmannii*. Namibia, Windhoek, Botanical Garden, 22°34'17.5''S, 17°05'36.7''E, 1.770 m asl., 5. 4. 2002, leg. M. Mennicken No. NA 163, 0 I II III. Paratypes (PREM, WIND).

The only known autoecious and macrocyclic rust fungus on Cucurbitaceae is *Puccinia cephalandrae* Thüm. (THÜMEN 1876: 425). After SYDOW & SYDOW (1904) *Puccinia cephalandrae* is synonymous with *Uredo cephalandrae* Thüm. (THÜMEN 1878: 355), *Uredo dolichospora* Kalchbr., and *Aecidium cephalandrae* Cooke (COOKE 1884: 6). DOIDGE (1927) has given a detailed description of *Puccinia cephalandrae*, which differs from *Puccinia windhoekensis* in having aecidioid aecia with a recurved peridium and in the much longer urediniospores (33–53 \times 16–20 μ m). DOIDGE (1927), additionally listed *Puccinia momordicae* Kalchbr. & Cooke in KALCHBRENNER (1882: 24), and *Puccinia trochomeriae* Cooke (COOKE 1882: 125) as

synonyms of *Puccinia cephalandrae*, and *Cephalandra*, *Coccinia*, *Cucumis*, *Kedrostis*, *Momordica*, *Trochomeria*, and *Zehneria* as host genera. We examined teliospores from a collection of *Puccinia cephalandrae* (B 70 0008488) and from a collection of *Puccinia momordicae* (B 70 0008485). They were paler than the teliospores of *Puccinia windhoekensis* and had a coarser relief, which consisted of irregular, bent or flexuous ridges. Similar to the teliospores of *Puccinia windhoekensis*, *Puccinia cephalandrae* and *Puccinia momordicae* have also 2 germ pores in each cell. We have not seen aecia of *Puccinia cephalandrae* or *Puccinia momordicae*.

Another rust fungus with autoecious life cycle on Cucurbitaceae is the demicyclic rust fungus *Puccinia cucumeris* Henn. (HENNING 1892: 371) (Type on *Cucumis ficifolius*, Abyssinia, Colon. Eritrea, near Keren on the river Dari, 14. 3. 1891, leg. G. Schweinfurth). We examined the holotype (B 70 0008495) but could not find uredinia or urediniospores.

Puccinia cucumeris differs from *Puccinia windhoekensis* in having smaller, \pm hyaline aeciospores (20–27 \times 16–22 μ m) with obscure germ pores and with a maximum thickness of the spore wall of up to 3 μ m in one edge, and in having teliospores (35–47 \times 26–36 μ m) with only one germ pore in each cell and pedicels which break short below the attachment.

For *Puccinia cephalandrae-indicae* Syd. & P. Syd. in SYDOW et al. (1906: 433) only teliospores are known. *Puccinia cephalandrae-indicae* differs from *Puccinia windhoekensis* in having smaller and thinner teliospores (32–42 \times 18–27 μ m) with a thinner spore wall (epispore circa 2 μ m) (SYDOW et al. 1906).

In the genus definition of *Puccinia* only one germ pore in each teliospore cell is quoted (CUMMINS & HIRATSUKA 2003). Nevertheless, some species of '*Puccinia*' exist having a second germ pore occasionally in the lower teliospore cell like *Puccinia abutili* (see below) or having a second germ pore in each teliospore cell like *Puccinia cephalandrae* (see above). The same is true for *Cumminsia* which, accordingly, falls well into a *Puccinia/Uromyces* cluster in a molecular phylogenetic study (MAIER et al. 2003).

Other characteristics of our specimens are *Caeoma*-type aecia with catenulate, verrucous aeciospores. After CUMMINS & HIRATSUKA (2003), the aecia of *Puccinia* "are *Aecidium*-type with peridium and catenulate and verrucose spores or *Uredo*-type with mostly echinulate spores borne singly on pedicels". According to the construction similarities between the telio- and urediniospores of *Puccinia windhoekensis* and *Puccinia cephalandrae* (DOIDGE 1927) we suppose that both rusts are closely related in spite of the absence of a peridium in the case of *Puccinia windhoekensis*. Nevertheless, both rust species should be included in molecular analyses to clarify their phylogenetic relationship.

One collection of '*Puccinia cucumeris*' on *Coccinia barteri* (Hook.) Keay in Nigeria (PUR F18688), which is published by EBOH (1981), may also belong to *Puccinia windhoekensis*. EBOH (1981) found only urediniospores with the size 24–28.8 \times 19.2–21.6 μ m.

FABACEAE – *ACACIA****Ravenelia halsei* Doidge (DOIDGE 1939: 504). Fig. 9**

Type on *Acacia ataxacantha* DC. South Africa, Natal, Ndwedwe, 26. 7. 1938, leg. R. H. Halse (PREM 30117).

Pycnia and aecia unknown.

Uredinia *Uredo*-type, on pods, amphigenous on leaves and on the petioles of the leaves, chiefly on the lower part of the leaflets and the secondary rachis, separate, scattered, confluent in the range of the secondary rachis, subepidermal, irregularly rupturing pustules up to 4 mm wide, roundish or irregular in outline, dark cinnamon-brown, early exposed, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules. Urediniospores borne singly on pedicels, oblong ellipsoid or pyriforme, sometimes irregularly shaped, 22–33 × 12–16 µm, finely echinulate, spore wall about 1–1.5 µm thick at the sides and about 1.5–2 (2.5) µm thick at the apex, golden-brown, germ pores conspicuous, 6 to 8 (to 12), when 6 equatorial, when more than 6 in a broader zone equatorial, with hyaline papillae that are weakly developed.

Telia rarely developed on the petioles of the leaves, chiefly on the lower part of the leaflets and the secondary rachis, subepidermal, blackish-brown, admixed with the uredinia, scattered, later confluent, surrounded by the torn epidermis, without spots surrounding telia. Teliospores slightly convex above and slightly concave below, circular or subcircular, 105–125 µm diameter, chestnut-brown, with 7 to 10 probasidial cells on every diameter, outer layer of the cells smooth, cell wall about 6–7 µm thick at the apex, with a thin, hyaline epispore and a thick, dark chestnut-brown endospore, with hyaline cysts on the abaxial surface of the teliospore, margins of the cysts diffusing in Hoyer's fluid, pedicel deciduous.

Specimens examined:

On *Acacia ataxacantha*. South Africa, Natal, Ndwedwe, 26. 7. 1938, leg. R. H. Halse, III. Type (PREM 30117). – On *Acacia hereroensis* Engl. Namibia, C 26, 22°49'10.8''S, 16°52'12.4''E, 1.964 m asl., 27. 4. 2002, leg. M. Mennicken No. NA 336, II. (PREM, WIND). – On *Acacia hereroensis*. Namibia, C 28 Khomas Hochland, 22°35'41.4''S, 16°52'27.4''E, 1.938 m asl., 21. 4. 2002, leg. M. Mennicken No. NA 321, II. (PREM, WIND). – On *Acacia hereroensis*. Namibia, C 30 Steinhausen - Gobabis, 21°48'33.9''S, 18°18'45.3''E, 1.676 m asl., 3. 4. 2002, leg. M. Mennicken No. NA 194, II III. (PREM, WIND). – On *Acacia hereroensis*. Namibia, D 2860, B 8 - Hoba Meteorite, 19°40'09.6''S, 17°52'25.9''E, 1.586 m asl., 16. 4. 2002, leg. M. Mennicken No. NA 288, II. (PREM, WIND).

Ravenelia halsei was only known from the South African type collection. Our collections agree well with the diagnosis of *Ravenelia halsei*, from which only teliospores were so far described (DOIDGE 1939). Therefore, urediniospores are described as new. *Acacia hereroensis* seems to be a new host plant and *Ravenelia halsei* is new to the rust flora of Namibia.

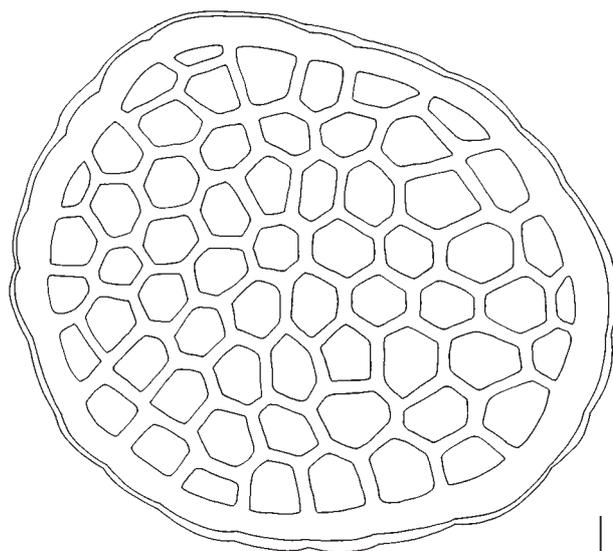
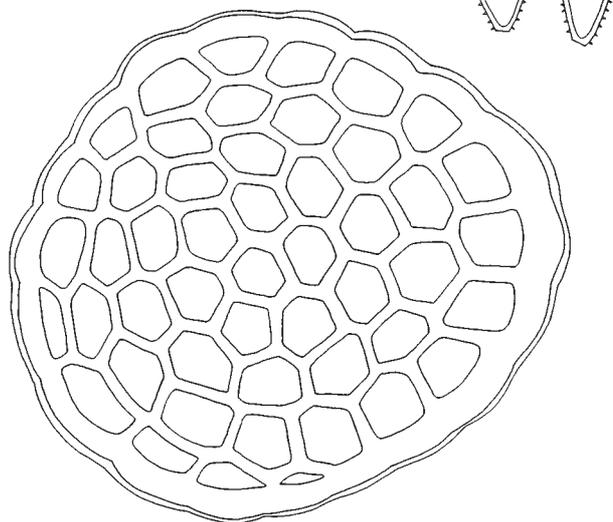
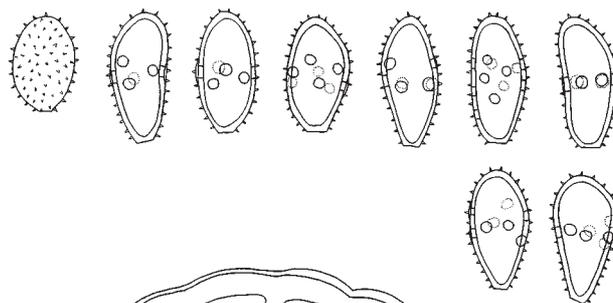


Fig. 9: *Ravenelia halsei* on *Acacia hereroensis*. Uredinio- and teliospores (NA 194). Scale bar = 10 µm.

Ravenelia transvaalensis* Doidge (DOIDGE 1939: 505).*Fig. 10**

Type on *Acacia mellifera* (Vahl) Benth subsp. *detinens* (Burch.) Brennan (as *Acacia detinens* Burch.) South Africa, Gauteng Province, near Pienaar's river, leg. Mogg (PREM 27382).

Pycnia in general abaxial on leaves, vis-à-vis of the telia, forming small, ± roundish groups up to 1 mm diameter, type 7.

Aecia and uredinia unknown.

Telia in general adaxial on leaves, vis-à-vis of the pycnia, subepidermal, dark reddish-brown to blackish-brown, sepa-

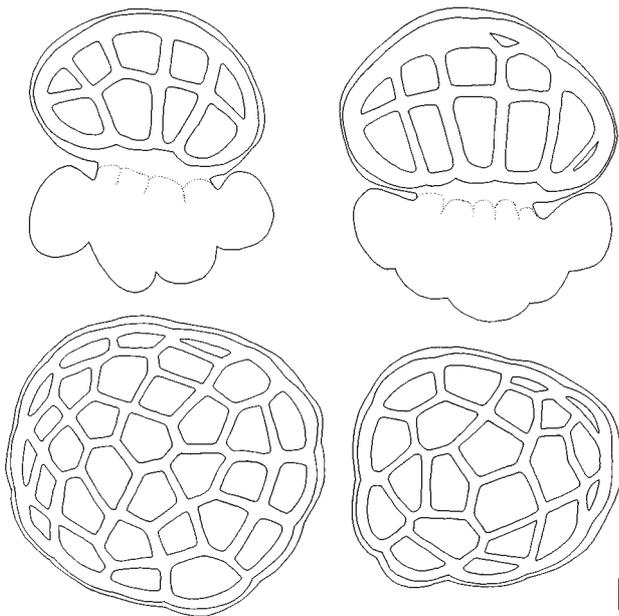


Fig. 10. *Ravenelia transvaalensis* on *Acacia mellifera*. Teliospores (NA 240). Scale bar = 10 μ m.

rate or scattered in confluent groups up to 2 mm diameter, roundish or irregular in outline, pulverulent, surrounded by the torn epidermis, without leaf spots surrounding telia, occasionally with inconspicuous paler green leaf spots. Teliospores convex above and slightly concave to even below, circular, subcircular, or irregular in outline, 60–115 μ m diameter, 45–60 μ m high, chestnut-brown, with 4 to 8 probasidial cells on every diameter, outer layer smooth, cell wall about 5–8 μ m thick at the apex, with a thin, hyaline to yellowish episporium and a thick, dark chestnut-brown endospore, with hyaline cysts on the abaxial surface of the teliospores, with sterile intercalary cells between the probasidial cells and the cysts, cysts equal in number to the marginal cells, margins of the cysts diffusing in Hoyer's fluid, pedicel deciduous.

Specimens examined:

On *Acacia mellifera* (Vahl) Benth. Namibia, C 36 Wilhelmstal - Omaruru, 21°31'02.4''S, 16°02'28.0''E, 1.287 m asl., 6. 4. 2002, leg. M. Mennicken No. NA 217, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, D 2337, short before C 33, riverbank, 21°04'56.3''S, 16°02'43.7''E, 1.537 m asl., 7. 4. 2002, leg. M. Mennicken No. NA 219, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, D 2337, 21°05'12.1''S, 15°58'42.4''E, 1.527 m asl., 7. 4. 2002, leg. M. Mennicken No. NA 226, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, C 39 Outjo - Otavi, 19°39'11.8''S, 16°59'54.8''E, 1.422 m asl., 9. 4. 2002, leg. M. Mennicken No. NA 240, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, C 39 near Otavi, 19°38'02.0''S, 17°19'23.4''E, 1.421 m asl., 9. 4. 2002, leg. M. Mennicken No. NA 249, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, C 73, near D 2848, 19°27'20.1''S, 18°07'42.7''E, 1.455 m asl., 15. 4. 2002, leg. M. Mennicken No. NA 267, 0 III. (PREM, WIND). – On *Acacia mellifera*. Namibia, D 2512, near Waterberg, 20°31'07.9''S, 17°15'33.5''E, 1.428 m asl., 19. 4. 2002, leg. M. Mennicken No. NA 313, 0 III. (PREM, WIND).

– On *Acacia mellifera*. Namibia, C 26 near Windhoek, 22°40'40.3''S, 16°59'17.9''S, 1.814 m asl., 27. 4. 2002, leg. M. Mennicken No. NA 330, 0 III. (PREM, WIND).

Ravenelia transvaalensis is only known from the type collection (DOIDGE 1939) and two herbarium specimens on *Acacia nigrescens*, Botswana, Mahalapye, leg. C.G. Hansford, 4. 1959, (BPI 191920, BPI 1110459) (FARR et al. n.d.). Our collections conform well with the diagnosis of *Ravenelia transvaalensis*, from which only teliospores were so far described (DOIDGE 1939). Pycnia are newly described. *Ravenelia transvaalensis* seems to be new to the rust flora of Namibia.

MALPIGHIACEAE – *TRIASPIS*

Puccinia ovamboensis Mennicken, Maier & Oberw. sp. nov. **Figs. 11 (Plate 1), 12**

Pycnia et aecia ignota. Uredinia caulicola vel amphigena, subepidermalia, cinnamomea, usque ad 1 mm diam., mox nuda, pulverulenta. Urediniosporae subgloboideae, obovoideae, pyriformes vel reniformes, 27–36 \times 19–27 μ m, pariete echinulato, aureo-fusco, 1.5–2.5 μ m crasso, 4–6 poris germinationis \pm aequatorialibus vel superaequatorialibus. Telia caulicola vel amphigena, subepidermalia, nigra, usque ad 1 mm diam., mox nuda, pulverulenta. Teliosporae bicellulares, ovoideae vel ellipsoideae, medio haud constrictae, apice rotundato vel subacuto, base rotundata vel attenuata, raro diorchidioideae, sanguineo-brunneae vel atro-fuscae, (38) 43–58 \times (23) 25–37 μ m, pariete grosse verrucoso, lateraliter 3–6 μ m crasso, apicaliter 4–12 μ m crasso, poris germinationis inconspicuis, pedicello hyalino, usque ad 60 μ m longo, base discoideo-dilatata.

In caulis foliisque *Triaspidis hypericoidis* (DC.) Burch. subsp. *nelsonii* (Oliv.) Immelmann (Malpighiaceae).

Pycnia and aecia unknown.

Uredinia *Uredo*-type, caulicolous or amphigenous on leaves, separate or scattered, subepidermal, small pustules, about 0.1–1 mm wide, roundish in outline, at first covered by the blistered epidermis, early exposed, cinnamon-brown, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules, early displaced by the telia. Urediniospores borne singly on pedicels, variably in shape, subglobose, obovoid, pyriform or reniform, often somewhat obliquely angular, 27–36 \times 19–27 μ m, finely echinulate, echinulation coarsely meshed, spore wall uniformly about 1.5–2.5 μ m thick, golden-brown, basal paler, germ pores conspicuous, 4 to 6, \pm equatorial to superequatorial, with hyaline papillae that are weakly developed.

Telia caulicolous and amphigenous on leaves, (partly) developing from the uredinia, separate or scattered in irregular groups which can cover the whole leaf surface, partly confluent, subepidermal, small pustules, about 0.1–1 mm wide, roundish or irregular in outline, at first covered by the blistered epidermis, early exposed, black, pulverulent, surrounded by the torn epidermis, without spots surrounding pustules. Teliospores bicellular, ovoid to ellipsoid, not constricted at the septum, rounded or slightly apiculate at the apex, rounded or attenuate at the base, occasionally diorchidioid, mahogany-

coloured to deep mahogany-coloured, (38) 43–58 × (23) 25–37 μm, spore wall about 3–6 μm thick at the sides, about 4–12 μm thick at the apex, gibbous, warts respectively tubercles coarse, closely crowded, germ pores obscure, pedicel persistent, up to 60 μm long, thick-walled, not collapsing, hyaline, sometimes obliquely inserted, consisting of a cylindrical to conical upper portion and a roundish to napiform swelling on the lower portion, margins of the swelling diffusing in Hoyer's fluid.

On the leaves of *Triaspis hypericoides* subsp. *nelsonii* (Malpighiaceae).

Etymology. Named after the biggest population group in Namibia, the Ovambo.

Specimens examined:

On *Triaspis hypericoides* subsp. *nelsonii*. Namibia, Otavi Mountains, D 3022, 19°25'04.8''S, 17°53'28.3''E, 1.478 m asl., 17. 4. 2002, leg. M. Mennicken No. NA 292, II III. Holotype (PREM), Isotype (WIND). – On *Triaspis hypericoides* subsp. *nelsonii* (= *Triaspis nelsonii* Oliv. var. *austro-occidentalis* Schinz). Namibia, Distr. Kaokoveld, Dolomite outcrop on mountainside 17.3 miles S of Kaoko-Otavi on road to Sesfontein, 21. 4. 1957, leg. de Winter & Leistner No. 5606, II III. Paratype (B 10 9009305).

The only known rust fungus on the host genus *Triaspis* is the rather similar *Puccinia haematites* Syd. & P. Syd. (SYDOW & SYDOW 1911: 260) (Type on *Triaspis auriculata* Radlk., Uganda, near Kibwezi, 23. 6. 1906, leg. G. Scheffler No. 4 on Herb. No. 46, Holotype B 70 0007785). *Puccinia haematites*, from which only teliospores are known, differs from *Puccinia ovamboensis* in having telia predominantly adaxial on leaves and in having smaller teliospores (32–42 × 22–28 μm) without an apical thickening (SYDOW & SYDOW 1911). We have examined the type material of *Puccinia haematites* and scaled up the measurement of the teliospores to 36–48 (50) × 22–33 μm. The teliospores of *Puccinia haematites* are either not at all or are only very slightly constricted at the septum and are rounded above and below. The colouration is pale mahogany-coloured to mahogany-coloured, and the spore wall is ± uniformly about 2.5–6 μm thick. Using light microscopy the spore wall ornamentation of *Puccinia haematites* seems to be very similar to those of *Puccinia ovamboensis*. In addition to the type collection from Uganda, *Puccinia haematites* is known from Ghana (CUMMINS 1960), Kenya (DUKE 1926), (NATTRASS 1961), and Tanzania (EBBELS & ALLEN 1979). None of the authors gave a description of the rust fungus, particularly EBBELS & ALLEN (1979) mentioned two collections, one with pycnia and uredinia and the other with pycnia, uredinia, and telia. No descriptions of the pycnia and uredinia of *Puccinia haematites* are available.

Because of the telia which are developed amphigenous on leaves and the bigger size of the teliospores with an usually apically thickened spore wall *Puccinia ovamboensis* is described as new.

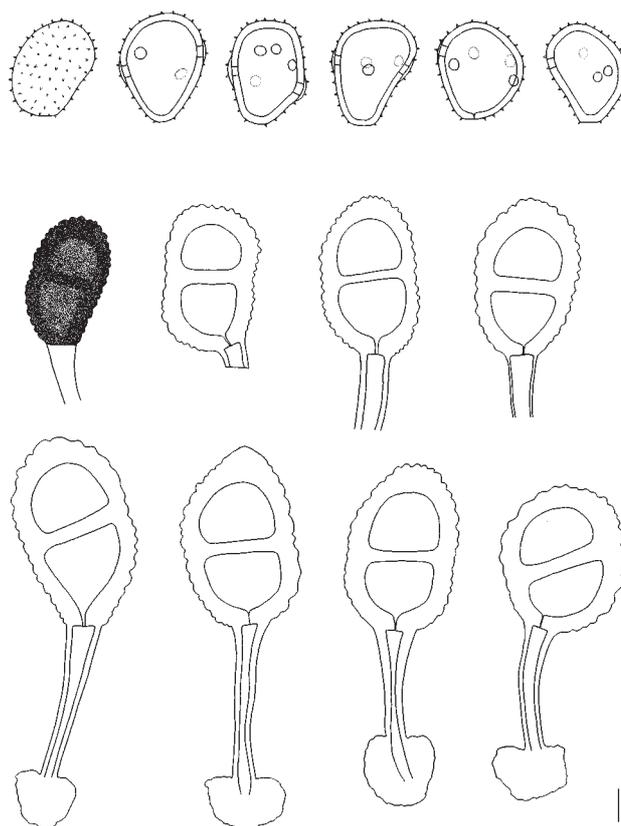


Fig. 12: *Puccinia ovamboensis* on *Triaspis hypericoides* ssp. *nelsonii*. Uredinio- and teliospores (Holotype NA 292). Scale bar = 10 μm.

MALVACEAE – *ABUTILON*

Puccinia abutili Berk. & Broome (BERKELEY & BROOME 1875: 91). **Figs. 13 (Plate 1), 14**

Type on *Abutilon graveolens*. Ceylon, Kandy, 2. 1868, No. 523.

Syn. *Puccinia carbonacea* Kalchbr. & Cooke in KALCHBRENNER (1882: 24). Type on *Abutilon* sp. South Africa, P. Natal, leg MacOwan No. 1275.

Pycnia rarely? present, admixed with the telia, type 4.

Aecia and uredinia unknown.

Telia amphigenous on leaves, usually abaxial, on petiole, on twigs, and on calyx, subepidermal, occasionally separate, usually scattered, arranged in concentrical, confluent blotches of up to 6 mm diameter, forming more elongated pustules and streaks along the veins of the leaves and along the twigs, or more or less scattered over the whole leaf surface by heavy infection, dark chocolate-brown, early exposed, pulverulent, surrounded by the torn epidermis, spots surrounding telia roundish or irregular in outline, yellowish, sometimes absent. Teliospores bicellular, ellipsoid to oblong, occasionally diorchidoid, not or slightly constricted at the septum, 31–44 × 19–30 μm, rounded or slightly attenuate at the apex and at the base, spore wall about 2–5 μm thick, not or slightly up to 5 μm thickened at the apex, brown, verrucous, upper germ pore api-

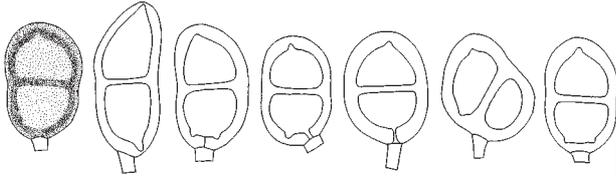


Fig. 14: *Puccinia abutili* on *Abutilon* cf. *austro-africanum*. Teliospores (NA 195). Scale bar = 10 μ m.

cal, sometimes obliquely inserted, lower germ pore just to one side of the pedicel, occasionally a second germ pore just to the other side of the pedicel, without papillae, pedicel normally up to 10 μ m long, occasionally up to 60 μ m long, thin-walled, persistent or not, not collapsing, hyaline, often obliquely inserted.

Specimens examined:

On *Abutilon angulatum* (Guill. & Perr.) Mast. Namibia, C 3016, 18°51'22.4''S, 18°28'48.5''E, 1.199 m asl., 13. 4. 2002, leg. M. Mennicken No. NA 274, III. (PREM, WIND). – On *Abutilon* cf. *austro-africanum* Hochr. Namibia, C 30 Steinhausen - Gobabis, riverbank of the Black Nossop, 22°22'53.7''S, 18°56'35.5''E, 1.479 m asl., 3. 4. 2002, leg. M. Mennicken No. NA 195, 0 III. (PREM, WIND). – On *Abutilon* cf. *austro-africanum*. Namibia, Ombeameiata, housecamp, 21°35'27.1''S, 18°01'14.0''E, 1.591 m asl., 2. 4. 2002, leg. M. Mennicken No. NA 183, III. (PREM, WIND). – On *Abutilon* cf. *austro-africanum*. Namibia, BIOTA-observatory at Toggekry 250 (Omatako-Ranch), 21°30'22.3''S, 16°44'05.7''E, 9. 3. 2002, leg. M. Mennicken No. NA 136, III. (PREM, WIND). – On *Abutilon* cf. *rehmannii* Baker f. Namibia, Steinhausen, camp W farmhouse, 21°48'37.5''S, 18°12'54.6''E, 1.666 m asl., 2. 4. 2002, leg. M. Mennicken No. NA 170, III. (PREM, WIND).

The microcyclic rust fungus *Puccinia abutili* is widespread in Africa (e.g. CROUS et al. 2000; DOIDGE 1927, 1950; EBOH 1984; GJÆRUM 1985, 1995; HENNINGS 1907; HOPKINS 1950; JØRSTAD 1956; KRANZ 1964; MAJEWSKI & NOWAK 1982; NATTRASS 1961; ROTHWELL 1983; SACCARDO 1910; SYDOW & SYDOW 1909; WAKEFIELD 1920; WAKEFIELD & HANSFORD 1949). Neither pycnia nor a second germ pore in the lower cell of the teliospores (see discussion under *Puccinia windhoekensis*) have been mentioned so far. *Puccinia abutili* is new to the rust flora of Namibia. *Abutilon austro-africanum* and *Abutilon rehmannii* seem to be new host plants.

SOLANACEAE – LYCIUM

Puccinia afra G. Winter (WINTER 1887: 26).

Figs. 15a, b (Plate 2), 16

Type on *Lycium afrum* L. South Africa, near Cape Town, 1886, leg. P. MacOwan.

Pycnia unknown.

Aecia not seen.

Uredinia *Uredo*-type, amphigenous on leaves, subepidermal, small pustules up to 1 mm wide, \pm roundish, separate or scat-

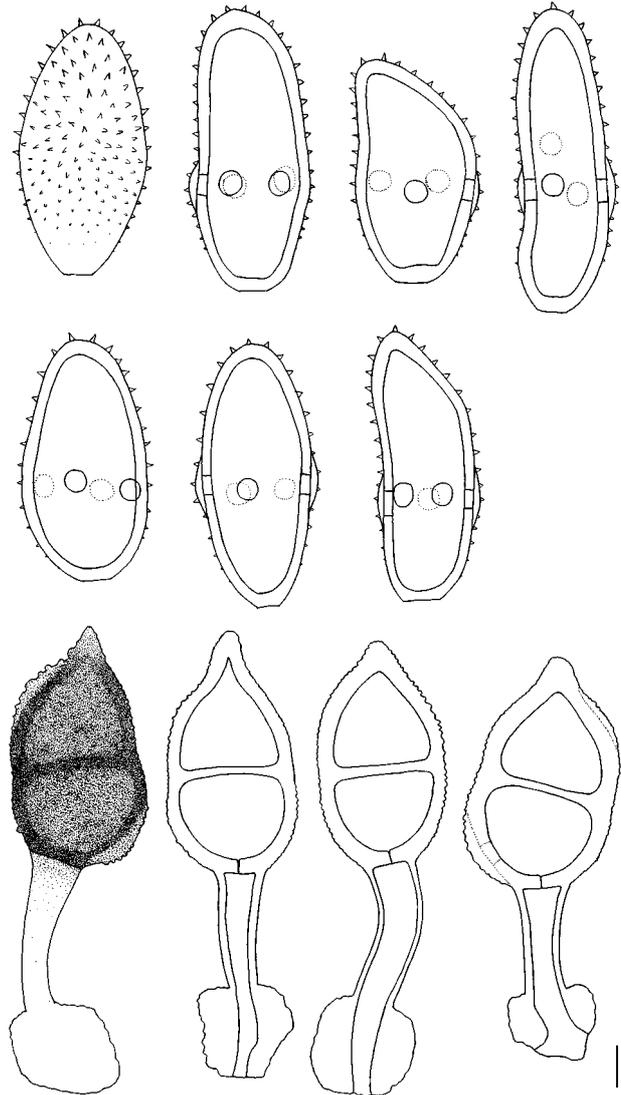


Fig. 16: *Puccinia afra* on *Lycium* sp. Uredinio- and teliospores (RSA 167). Scale bar = 10 μ m.

tered, without spots surrounding uredinia, cinnamon-brown, early exposed, pulverulent and surrounded by the torn epidermis. Urediniospores ellipsoid to oblong, (48) 51–66 (72) \times 20–33 μ m, slightly attenuate at the apex, rounded at the base, smooth in the lower one sixth, echinulate in the upper five sixths of the spore, spines becoming continuously larger from the lower parts to the apex, spore wall about 2–3 μ m thick at the sides, about 3–5 μ m thick at the apex, yellowish-brown, germ pores 4 to 5, supraequatorial, with hyaline papillae that are medium developed.

Telia amphigenous on leaves, subepidermal, small pustules up to 1 mm wide, roundish, separate or scattered, partially replacing the uredinia, blackish-brown, early exposed, pulverulent, without spots surrounding telia, surrounded by the torn epidermis. Teliospores bicellular, ellipsoid, not or slightly constricted at the septum, 46–56 \times 26–31 μ m, acuminate at the apex, apex drawn out into a yellowish cone-shaped apicule,

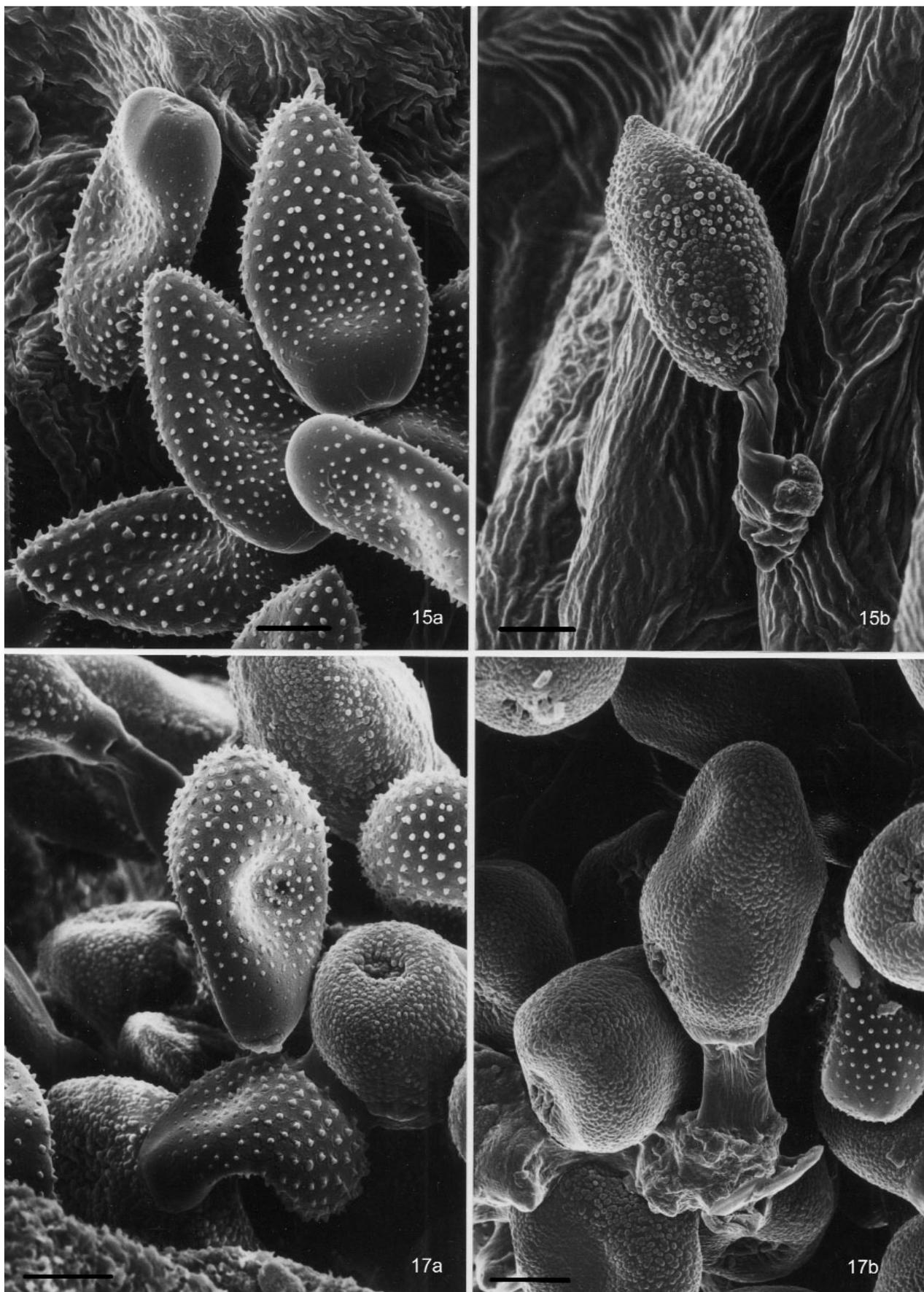


Plate 2. Fig. 15. *Puccinia afra* on *Lycium* sp. (RSA 167). SEM. Scale bars = 10 μ m. **a.** Urediniospores. **b.** Teliospore. **Fig. 17.** *Puccinia lycii* on *Lycium* sp. (RSA 177). SEM. Scale bars = 10 μ m. **a.** Uredinio- and teliospores. **b.** Teliospores and urediniospore.

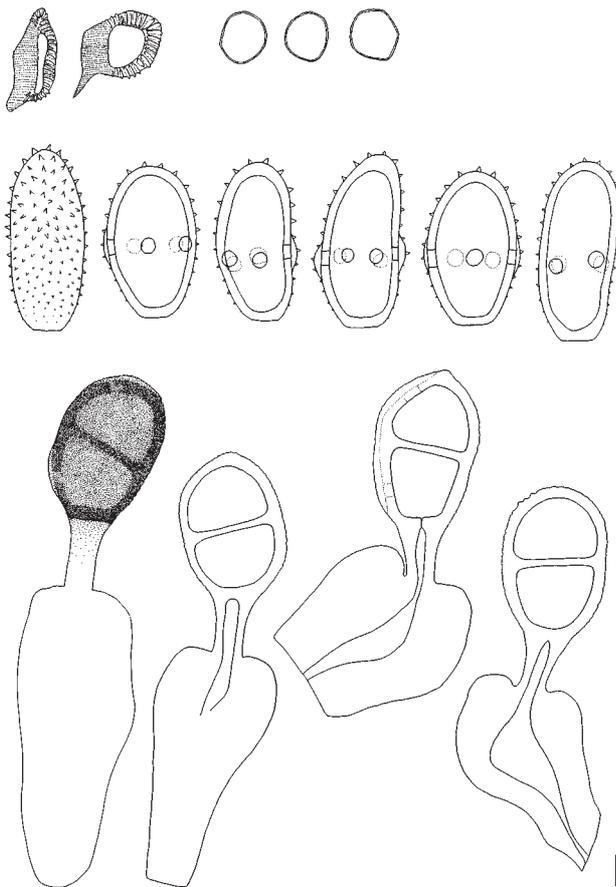


Fig. 18: *Puccinia lycii* on *Lycium* sp. Peridium cells, accio-, uredinio-, and teliospores (RSA 177). Scale bar = 10 μ m.

rounded at the base, spore wall about 2–3.5 μ m thick at the sides, about 5–10 μ m thick at the apex, dark chestnut-brown, densely and roughly verrucous, upper germ pore centrally between the apex and the septum, lower germ pore centrally between the septum and the base, with yellowish papillae, pedicel up to 80 μ m long, thick-walled, persistent, consisting of a cylindrical upper portion and a vesiculous inflation with irregular crenate margins on the lower portion, margins of the swelling diffusing in Hoyer's fluid, yellowish in the upper portion, hyaline in the lower portion.

Specimens examined:

On *Lycium* sp. South Africa, Western Cape Province, BIOTA-observatory at Moedverloren 208, 31°27'40.1''S, 18°26'31.3''E, 18. 9. 2002, leg. M. Mennicken No. RSA 167, II III. (PREM, WIND). – On *Lycium* sp. South Africa, Western Cape Province, BIOTA-observatory at Moedverloren 208, 31°27'43.2''S, 18°26'27.3''E, 119 m asl., 18. 9. 2002, leg. M. Mennicken No. RSA 175, II III. (PREM, WIND).

Our collections conform well with the description of *Puccinia afra* given by DOIDGE (1927).

Puccinia lycii Kalchbr. (KALCHBRENNER 1882: 21).

Figs. 17a, b (Plate 2), 18

Type on *Lycium tubulosum* Nees. South Africa, Somerset East, leg. MacOwan No. 1410 (B 70 0007290).

Pycnia unknown.

Aecia rarely developed, *Aecidium*-type, amphigenous? on leaves, densely scattered in small and roundish groups up to 2 mm diameter, without spots surrounding aecia, aecial cups small, spore mass creamish-white or white, surrounded by irregularly and finely lacerated, white to light brownish peridium, cells of the peridium medium connected, outer wall finely striate, inner wall coarsely verrucous. Aeciospores angular globoid, subgloboid to ellipsoid, 13–20 \times 11–15 μ m, spore wall 0.5–1 μ m, hyaline, germ pores inconspicuous.

Uredinia *Uredo*-type, amphigenous on leaves, subepidermal, small pustules, \pm roundish, up to 1 mm wide, separate or scattered, without spots surrounding uredinia, foxy red, early exposed, pulverulent and surrounded by the torn epidermis. Urediniospores ovoid, ellipsoid to oblong, 45–53 (65) \times (21) 23–27 (30) μ m, smooth in the lower one tenth, echinulate in the upper nine tenths of the spore, spines becoming continuously larger from the lower parts to the apex, spore wall about (1.5) 2–2.5 μ m thick at the sides, about 3–4 μ m thick at the apex, yellowish-brown, germ pores 4 to 6 and slightly supra-equatorial, with hyaline papillae that are medium developed.

Telia amphigenous on leaves and on twigs, subepidermal, small pustules up to 1.5 mm, roundish, separate or scattered, partially replacing the uredinia, blackish-brown to black, early exposed, without spots surrounding telia, surrounded by the torn epidermis. Teliospores bicellular, ellipsoid to oblong, not or slightly constricted at the septum, 43–52 \times 27–33 μ m, rounded or acuminate at the apex, rounded at the base, spore wall about 2–4 μ m thick at the sides, about 3–6 μ m thick at the apex, (dark) chestnut-brown, finely verrucous, warts irregularly, closely meshed, brownish-yellow, upper germ pore centrally between the apex and the septum, occasionally at the apex, lower germ pore \pm centrally between the septum and the base, with brownish-yellow papillae, pedicel persistent, up to 110 μ m long, thick-walled, consisting of a short cylindrical upper portion and a long napiform inflation on the lower portion, margins of the swelling diffusing in Hoyer's fluid, yellowish in the upper portion, hyaline in the lower portion.

Specimens examined:

On *Lycium tubulosum* Nees. South Africa, Somerset East, leg. MacOwan No. 1410, ex Herbar Winter, III. (Type B 70 0007290). – On *Lycium* sp. South Africa, Western Cape Province, BIOTA-observatory at Moedverloren 208, 31°27'52.1''S, 18°26'31.1''E, 136 m asl., 18. 9. 2002, leg. M. Mennicken No. RSA 177, I II III. (PREM, WIND).

Our collection agrees well with the description of *Puccinia lycii* given by DOIDGE (1927). In South Africa *Puccinia lycii* is known from four *Lycium* species in the provinces Free-State and Eastern Cape (CROUS et al. 2000). Until now only uredinia and telia were known. The aecia are newly described.

***Puccinia turgida* P. Syd. & Syd. (SYDOW & SYDOW 1904: 266). Figs. 19a, b (Plate 3), 20**

Type on *Lycium europaeum* L. Palaestina, near Jericho, 300 m asl., 29. 3. 1897, leg J. Bornmüller, Iter Syriacum 1897 No. 1021. (B 70 0007287).

Pycnia rarely developed, amphigenous? in the centre of the aecia, type 4.

Aecia *Aecidium*-type, amphigenous on leaves, densely scattered in small and roundish groups up to 3 mm diameter, without spots surrounding aecia, aecial cups small, erumpent, circa 300 µm diameter, up to 1 mm tall, spore mass whitish-yellow or white, surrounded by irregularly and finely lacerated, white to light brownish peridium, cells of the peridium medium connected, outer wall smooth, inner wall coarsely verrucous. Aeciospores angular subglobose, cuboid to ellipsoid, 27–36 × 20–28 µm, delicately verrucous, spore wall 1–2 µm, hyaline, germ pores inconspicuous.

Uredinia *Uredo*-type, amphigenous on leaves, subepidermal, small pustules, ± roundish, up to 1 mm wide, separate or scattered, without spots surrounding uredinia, cinnamon-brown, early exposed, pulverulent and surrounded by the torn epidermis. Urediniospores obovoid, ellipsoid to oblong, (32) 36–51 × (17) 19–25 µm, smooth in the lower one fifth, echinulate in the upper four fifths of the spore, spines becoming continuously larger from the lower parts to the apex, spore wall about 1.5–2.5 µm thick at the sides, about 2–2.5 µm thick at the apex, yellowish-brown, germ pores generally 4 to 5 and equatorial to slightly supraequatorial, occasionally up to 8 and tending to be bizonate with 4 to 5 germ spores in a lower zone and 1 to 3 germ pores in an upper zone, with hyaline papillae that are medium developed.

Telia amphigenous on leaves, subepidermal, small pustules up to 1 mm, roundish, separate or scattered, partially replacing the uredinia, black, early exposed, without spots surrounding telia, surrounded by the torn epidermis. Teliospores bicellular, ellipsoid to oblong, not or slightly constricted at the septum, 39–55 (60) × 27–38 µm, rounded or acuminate at the apex, rounded at the base, spore wall uniformly about 2–4 µm thick, not or slightly up to 5 µm thickened at the apex, chestnut-brown, roughly verrucous, warts and tubercle irregularly, sparsely to coarsely meshed, brownish-yellow, germ pore of the upper cell central between the apex and the septum, germ pore of the lower cell central between the septum and the base, with brownish-yellow papillae, spore wall with papilla up to 6 µm thick, pedicel up to 55 µm long, thick-walled, persistent, consisting of a cylindrical upper portion and a napiform inflation on the lower portion, margins of the swelling diffusing in Hoyer's fluid, yellowish in the upper portion, hyaline in the lower portion, occasionally obliquely inserted.

Specimens examined:

On *Lycium europaeum*. Palaestina, near Jericho, 300 m asl., 29. 3. 1897, leg J. Bornmüller, II III. Iter Syriacum 1897 No. 1021. Type, but labelled as type of *Puccinia lycii* Kalchbr. nov. var. *asiatica* Sydow (B 70 0007287). – On *Lycium europaeum*. Palaestina,

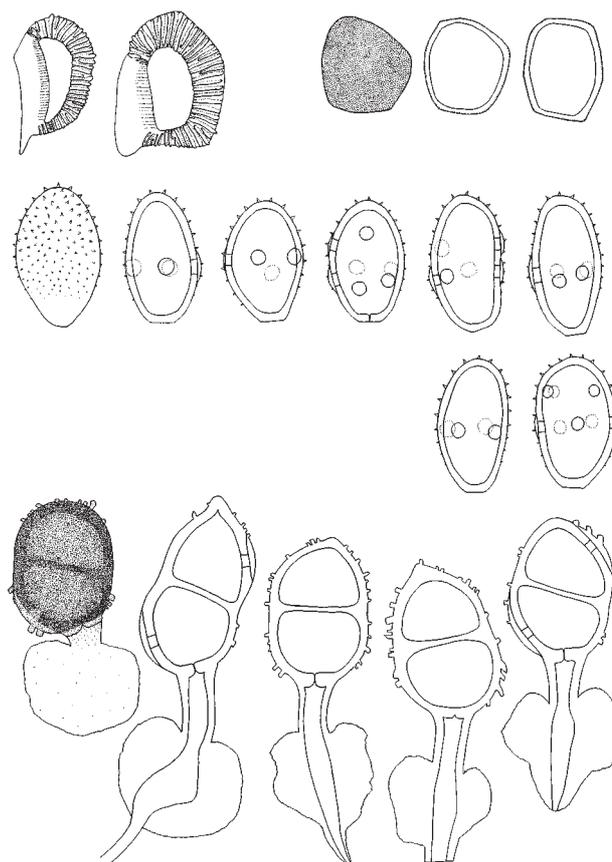


Fig. 20: *Puccinia turgida* on *Lycium* cf. *oxycarpum*. Peridium cells and aeciospores (NA 206), uredinio- and teliospores (NA 223). Scale bar = 10 µm.

near Jericho, II III. Kryptogamae exsiccatae No. 802 (B 70 0007281). – On *Lycium* cf. *oxycarpum* Dunal. Namibia, D 1852 Witvlei - Omিতara, short behind B 6, 22°21'20.6''S, 18°04'35.6''E, 1.595 m asl., 4. 4. 2002, leg. M. Mennicken No. NA 206, 0 I. (PREM, WIND). – On *Lycium* cf. *oxycarpum*. Namibia, D 1852 Nossop - Seeis, 22°19'29.7''S, 17°43'11.3''E, 1.608 m asl., 4. 4. 2002, leg. M. Mennicken No. NA 207, II III. (PREM, WIND). – On *Lycium* cf. *oxycarpum*. Namibia, B 1 Windhoek - Okahandja, riverbank of the Swakop, 22°02'03.2''S, 16°56'08.9''E, 1.346 m asl., 6. 4. 2002, leg. M. Mennicken No. NA 214, 0 I II III. (PREM, WIND). – On *Lycium* cf. *oxycarpum*. Namibia, D 2337, short before C 33, riverbank, 21°04'57.6''S, 16°02'44.3''E, 1.539 m asl., 7. 4. 2002, leg. M. Mennicken No. NA 223, II III. (PREM, WIND). – On *Lycium* sp. Namibia, Okahandja, 1.200 m asl., 1. 7. 1907, leg Kurt Dinter No. 597, III. (B 70 0007276).

The type collection is labelled as a type of *Puccinia lycii* Kalchbr. nov. var. *asiatica* Sydow. H. & P. Sydow did not publish this name. MAGNUS (1900: 437) cited the same collection as *Puccinia lycii* Kalchbr. We propose that H. & P. Sydow first wanted to describe a new variant of *Puccinia lycii*. Later, they described a new species without changing the inscription of the herbarium specimen. Until now only uredinia and telia were known. The aecia are described as new.

This rust fungus differs clearly from all other known species of *Puccinia* with verrucous teliospores on *Lycium*:

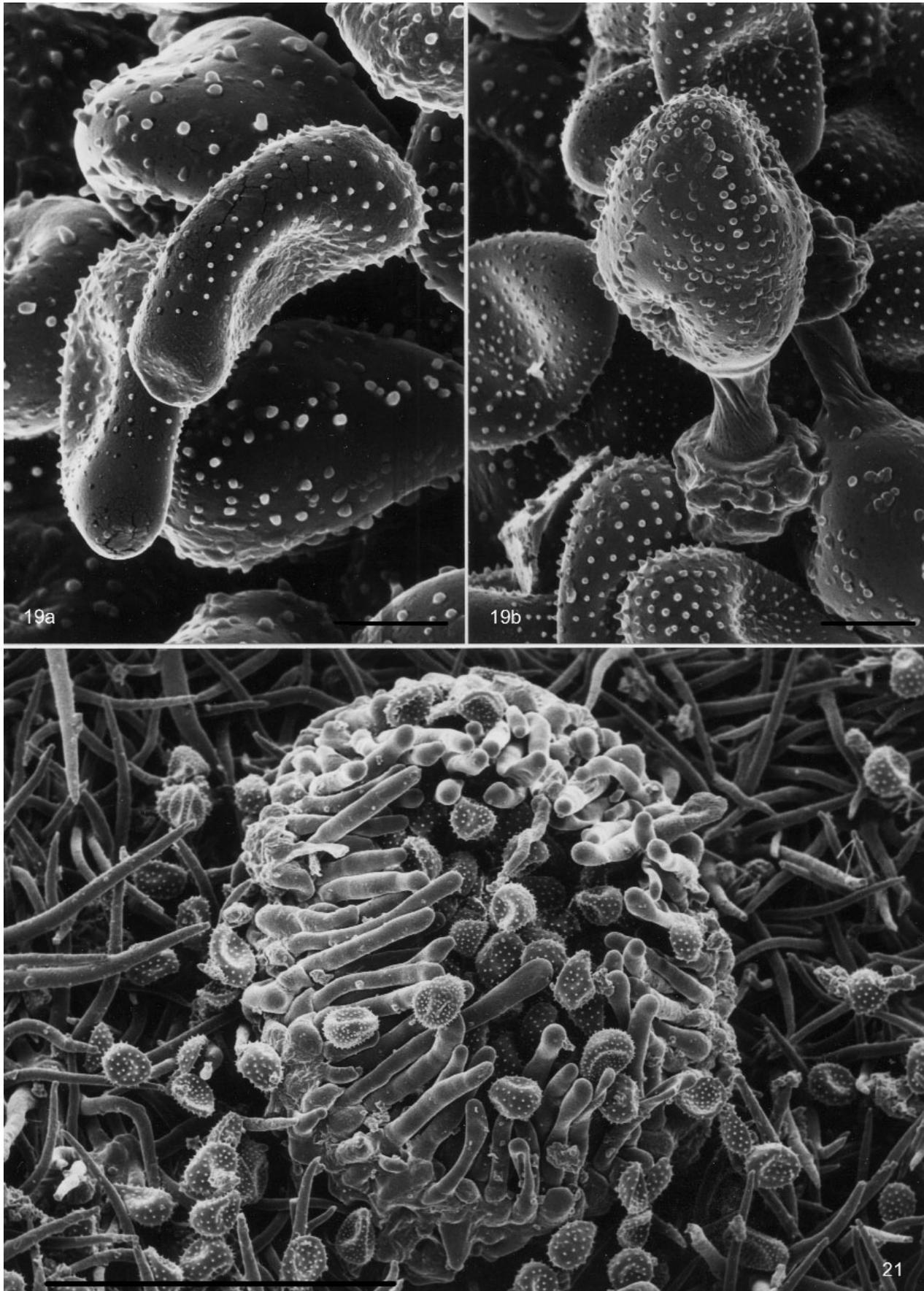


Plate 3. Fig. 19. *Puccinia turgida* on *Lycium* cf. *oxycarpum*. (NA 207). SEM. Scale bars = 10 μ m. **a.** Uredinio- and teliospores. **b.** Telio- and urediniospores. **Fig. 21.** *Uredopeltis flavae* on *Grewia flava*. Uredinium with peripheral paraphyses (Holotype NA 293). SEM. Scale bar = 100 μ m.

Puccinia afra (see above) has longer uredinio- and teliospores with close-by warts. *Puccinia spinulosa* Jørst. (JØRSTAD 1956: 592), from which only teliospores are known, differs in having smaller teliospores with “upper germ pore usually somewhat depressed, lower germ pore in the lower part of basal cell, often near pedicel”. *Puccinia lycii* (see above) has very finely verrucous teliospores. *Puccinia globosipes* Peck (PECK 1885: 34) lacks the cylindrical upper portion of the pedicel, and the teliospores are smaller. *Puccinia verwoerdiana* Van der Byl (VAN DER BYL 1927: 226) has longer urediniospores. *Puccinia turgida* is new to the rust flora of Namibia. *Lycium oxycarpum* seems to be a new host plant.

TILIACEAE – *GREWIA*

Uredopeltis flavae Mennicken, Maier & Oberw. sp. nov.

Figs. 21 (Plate 3), 22

Pycnia et aecia ignota. Uredinia abaxialia, corbuliformia, in lacunis foliorum nata, sparsa vel laxe aggregata, usque ad 350 μm diam., paraphysibus peripheralibus numerosis, incurvatis, brunneis, usque ad circa 120 μm longis, 5–12 μm latis, deorsum conjunctis, pariete irregulari, 1–5 μm crasso, apicaliter incrassato usque ad 15 μm . Urediniosporae subgloboideae, ellipsoideae, guttiformes vel pyriformes, 18–29 \times 15–18 μm , pariete echinulato, hyalino vel dilute aureo, 1–1.5 μm crasso, 2–6 poris germinationis inconspicuis, approx. aequatorialibus. Telia abaxialia, subepidermalia, erumpentia, sparsa vel laxe aggregata, nigro-brunnea vel nigra, usque ad 250 mm diam., paraphysibus peripheralibus. Teliosporarum massa lateraliter circa 17–23 sporis, verticaliter circa 12–25 sporis, circa 140–220 μm diam., circa 130–240 μm alta aggregata, sporis singularibus unicellularibus, 12–27 \times 9–15 μm , pariete castaneo.

In foliis *Grewiae flavae* DC. (Tiliaceae).

Pycnia and aecia unknown.

Uredinia abaxial on leaves, separate or scattered in irregular groups, partly admixed with the telia, forming roundish sori which are bordered by numerous, conspicuous, brown paraphyses, sori superepidermal, with an elongate, basal stipe-like structure which is deeply seated in the leaf tissue and arises from cavities or sunken areas which are typically for leaves of the host plant, up to 350 μm diameter, pulverulent, covered by the pale brownish urediniospores, without leaf spots surrounding uredinia. Stipe-like structure consisting of several lateral united, septate, hyaline hyphae. Paraphyses surrounding uredinia in great quantities arise from the stripe-like structure, incurved, cylindrical, occasionally clavate or capitate, often irregular in outline, septate, basally united and/or coadunate, up to circa 120 μm long and about 5–12 μm wide. The wall of the paraphyses irregularly about 1–5 μm thick, up to 15 μm thick at the apex, brown to chestnut-brown. Urediniospores being produced from the apical layers of the stipe-like, cellular base, sessile or nearly so, subglobose, ellipsoid, drop-shaped or pyriform, 18–29 \times 15–18 μm , echinulate, echinulation generally coarsely meshed, spore wall uniformly about 1–1.5 μm thick, yellowish to hyaline, germ pores inconspicuous, 2 to 6, generally \pm equatorial, without papillae.

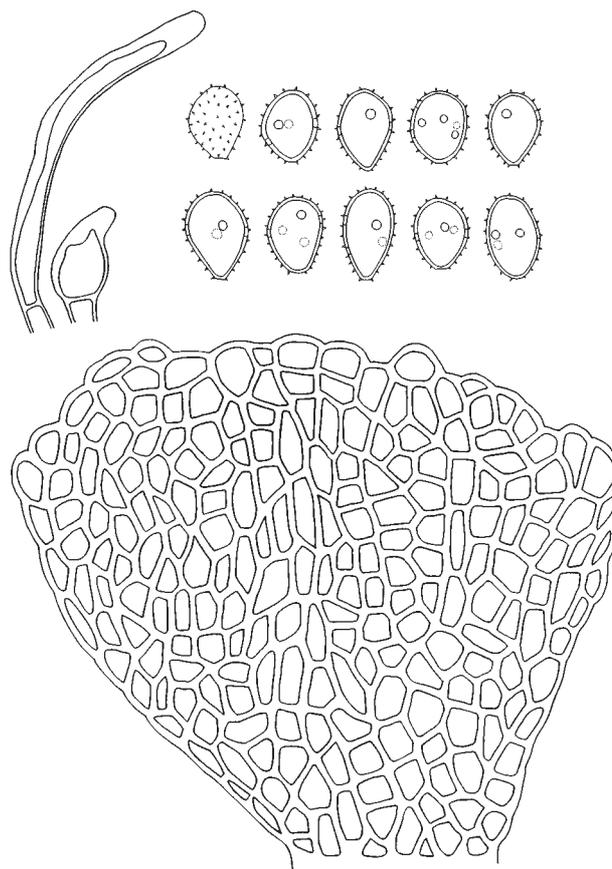


Fig. 22. *Uredopeltis flavae* on *Grewia flava*. Paraphyses, urediniospores, and a teliospore crust (Holotype NA 293). Scale bar = 10 μm .

Telia abaxial on leaves, separate or scattered in irregular groups, often admixed with the uredinia, developing partly from the uredinia, subepidermal in origin but becoming erumpent, chocolate-brown to blackish pustules, up to 250 mm wide, roundish, ellipsoid, or irregular in outline, compact to cushionlike, early exposed, without leaf spots surrounding telia. Paraphyses partly surrounding telia in great quantities (attributes see uredinia) probably relicts from the uredinia after transmutation from uredinia to telia. Teliospores jointed together in catenulate or irregular arranged crusts, which consist of circa 17 to 23 lateral spores and of circa 12 to 25 vertical spores. Crusts circa 140–220 μm diameter, circa 130–240 μm high, compact and generally without spaces between single spores. Spores unicellular, variable in shape, angular globoid, subglobose, ellipsoid, ovoid, oblong or irregular in outline, 12–27 \times 9–15 μm , spore wall brown to chestnut brown in the upper spores, hyaline in the lower spores, becoming progressively darker from the base towards the apex, smooth, in the lower spores uniformly about 1–1.5 μm thick, in the upper spores about 1–1.5 μm thick at the sides, up to 3 μm thick at the apex, germ pore inconspicuous in the upper spores, obscure in the lower spores, apical, with hyaline papilla that is weakly developed.

On the leaves of *Grewia flava* DC. (Tiliaceae).

Etymology. Named after the host plant, *Grewia flava*.

Specimen examined:

On *Grewia flava* DC. Namibia, Otavi Mountains, D 3022, 19°25'04.0''S, 17°53'28.4''E, 1.479 m asl., 17. 4. 2002, leg. M. Mennicken No. NA 293, II III. Holotype (PREM), Isotype (WIND).

As far as could be established there are eight known rust fungi on *Grewia*:

Aecidium warneckeanum Henn. (HENNING 1907: 105) (Type on *Grewia carpinifolia*, Ost-Usambara, Amani, 09. 1903, leg. Warnecke & Eichelbaum No. 106) forms "an Zweigen große, geweihartig verzweigte Hexenbesen".

Cumminsina clavispora Petr. (PETRAK 1955: 474) (Type on *Grewia nenensis*, Angola, Huila Banks of River Nene, near Humpata) forms teliospores "consisting of chains of laterally adherent cells forming a club-shaped, pigmented head, pedicel simple basally but with apical cells equal in number of the chains of cells" (CUMMINS & HIRATSUKA 2003).

Kuehneola grewiae (Thirum. & Mundk.) Thirum. (THIRUMALACHAR 1960: 692) (Syn. *Catenulopsora grewiae* Thirum. & Mundk. (THIRUMALACHAR & MUNDKUR 1951: 13/14), type on *Grewia populifolia* Vahl, India, Punjab) differs from *Uredopeltis flavae* inter alia in having teliospores in separated, permanently united chains, 16–20 spores per chains (THIRUMALACHAR & MUNDKUR 1951).

Phakopsora microspora Cummins (CUMMINS 1960: 37) (Type on *Grewia carpinifolia* Fuss. Ghana, Biriwa, 3. 11. 1957, leg. L. Piening CB 2620, IMI, PUR) differs from *Uredopeltis flavae* in having smaller urediniospores (16–19 × 14–17 µm) and shorter and narrower paraphyses (20–35 µm long and 6–8 µm wide) (CUMMINS 1960). The teliospores are smaller: (6) 8–11 (13) × (8) 11–17 (20) µm (CUMMINS 1960).

Puccinia tiliifoliae T.S. Ramakr. & Sundaram (as *Puccinia tiliaefoliae*) (RAMAKRISHNAN & SUNDARAM 1955: 194) (Type on *Grewia tiliifolia* Vahl. (as *Grewia tiliaefolia*). India, Madras, Ambalavayal (Malabar), 3. 9 1954, leg. N.V. Sundaram) has bicellular teliospores with persistent pedicels. Mesospores are commonly, tricellular teliospores rarely developed.

Ravenelia atrides Syd. & P. Syd. (SYDOW & SYDOW 1912a: 438) (Type on *Grewia caffra*. South Africa, Natal, Durban, 7. 7. 1911, leg. Pole Evans No. 1670) differs from *Uredopeltis flavae* in having dark and dull brown, opaque teliospore heads, 110–190 µm diameter, with 15–22 spores in each diameter and with an epispore about 4–10 µm thick (DOIDGE 1927). We have examined the type collection of *Ravenelia atrides* (S F29702). The teliospore heads differentiate *Ravenelia atrides* undoubtedly from *Uredopeltis flavae*. The urediniospores of the type collection of *Ravenelia atrides* measure 15–22 (24) × 13–16 µm.

Uredo corbiculoides Cummins (CUMMINS 1945: 219) (Type on *Grewia* sp. Uganda, Serere, Teso, 3. 1933, leg. Hansford

No. 1630), from which Cummins published a LM-micrograph, has uredinia which are constructed similar to those of *Uredopeltis flavae*. It differs from *Uredopeltis flavae* in having shorter urediniospores (16–20 × 13–16 µm) and thinner-walled paraphyses (about 1–2 µm thick, up to 4 µm thick) (CUMMINS 1945).

Uredopeltis chevalieri (see below) differs from *Uredopeltis flavae* in the construction of uredinia with shorter, paler paraphyses. The teliospore heads of *Uredopeltis chevalieri* are smaller and consist of fewer cells. CUMMINS (1945) published a LM-micrograph of a telium.

Our collection conforms well with the characteristics of the genus *Uredopeltis* (HENNING 1908: 223). LAUNDON (1963b) re-examined the genus and published two LM-micrographs of telia. CUMMINS & HIRATSUKA (2003) stated that "*Uredopeltis* appears to be similar to *Phakopsora* and *Physopella*, but the latter have non-erumpent telia".

Uredopeltis* cf. *chevalieri (Pat. & Har.) J. Walker & R.G. Shivas (WALKER & SHIVAS 2004: 43). **Fig. 23**

Type on *Grewia breviflora* Benth. Australia, Western Australia, Kimberley region, Beverley Springs Station, 9. 5. 1995, leg. A. A. Mitchell (Holotype PERTH 3970574, Isotype DAR 74838).

Anamorph. *Uredo grewiae* Pat. & Har. (PATOULLARD & HARIOT 1900: 237). Type on *Grewia ferruginea* Hochst. Senegal, Cayor, near Thies.

Syn. *Phakopsora grewiae* (Pat. & Har.) Cummins (CUMMINS 1945: 206). Type on *Grewia* sp. Senegal, Thies (Cayor), leg. Chevalier.

Syn. *Dasturella grewiae* (Pat. & Har.) Thirum. (THIRUMALACHAR 1946: 348). Type on *Grewia monticola* Sond. South Africa, Nelspruit? (as Kelspruit), Tvl., Experimental Station, 2. 8. 1940 (PREM? No. 32401).

Syn. *Uredopeltis grewiae* (Cummins) Sathe (SATHE 1969: 176). Type on *Grewia asiatica* L. India, Poona.

Pycnia and aecia unknown.

Uredinia amphigenous on leaves, subepidermal, separate or scattered in irregular groups, partly admixed with the telia, brown to pale brown pustules, small, up to 150 µm wide, roundish, ellipsoid or irregular in outline, long remaining covered by the epidermis, opening through an apical pore, later gapping, surrounded by the torn epidermis, pulverulent, covered by the pale brownish urediniospores, generally surrounded by brownish leaf spots, spots often margined by the nerves of the host leaves. Paraphyses surrounding uredinia in great quantities are incurved, cylindrical, often irregular in outline, about 25–75 µm long and about 5–12 µm wide, wall of the paraphyses about 1 µm thick at the base, up to 4 µm thick near the apex, yellowish-brown to hyaline. Urediniospores subglobose, ellipsoid, drop-shaped or pyriform, 16–29 × 12–17 µm, slightly echinulate, spore wall uniformly between 0.5–1.5 µm thick, yellowish to hyaline, germ pores inconspicuous, 3 to 5, ± equatorial, without papillae.

Telia amphigenous on leaves, separate or scattered in irregular groups, often admixed with the uredinia, partly develop-

ing from the uredinia, subepidermal in origin but becoming erumpent, chocolate-brown pustules small, up to 250 μm wide, roundish, ellipsoid, oblong, or irregular in outline, compact to cushion-like, long remaining covered by the epidermis, later exposed, generally surrounded by brownish leaf spots, spots often margined by the nerves of the host leaves. Paraphyses partly surrounding telia in great quantities (attributes see uredinia), probably relicts from the uredinia after transmutation from uredinia to telia. Teliospores jointed together in catenulate or irregularly arranged crusts which consist of circa 10 to 18 lateral spores and of circa 5 to 11 vertical spores. Crusts measure circa 80–180 μm diameter, circa 60–120 μm high, at the beginning compact and without spaces between single spores, later becoming disintegrated and releasing the spores. Spores unicellular, variable in shape and size, globoid, subgloboid, ellipsoid, ovoid, oblong, amygdaline, drop shaped, or irregular in outline, often angular, 10–29 \times 6–16 μm , spore wall brown to chestnut brown, smooth, about 0.5–2 μm thick at the sides, up to 3 μm thick at the apex, germ pore inconspicuous in the upper spores, obscure in the lower spores, apical, with a weakly developed hyaline papilla.

Specimens examined:

On *Grewia flavescens* Juss. Namibia, Koukuas, 18°54'17.4''S, 18°17'16.0''E, 1.210 m asl., 14. 4. 2002, leg. M. Mennicken No. NA 264, II III. (PREM, WIND). – On *Grewia flavescens*. Namibia, Otavi Mountains, D 2863, 19°30'50.1''S, 17°44'42.5''E, 1.659 m asl., 17. 4. 2002, leg. M. Mennicken No. NA 298, II III. (PREM, WIND). – On *Grewia flavescens*. Namibia, C 39 near Otavi, 19°38'00.2''S, 17°19'24.2''E, 1.416 m asl., 9. 4. 2002, leg. M. Mennicken No. NA 252, II III. (PREM, WIND).

Our collections do not conform in all details with the characteristics of *Uredopeltis chevalieri* and its synonymous species. Therefore, we use the prefix cf. before the epithet. The urediniospores reported so far are slightly broader than in our collections: 21–28 \times 16–21 μm (*Grewia ferruginea*: PATOULLARD & HARIOT 1900), 20–28 \times 15–21 μm (*Grewia* sp.: CUMMINS 1945), 20–26 \times 15–20 μm (*Grewia monticola*: THIRUMALACHAR 1946), 18–26 \times 15–19 μm (*Grewia pubescens* Beauv.: VIENNOT-BOURGIN 1953), and (22) 24–31 (37) \times (17) 18–21 (22) μm (*Grewia breviflora*: WALKER & SHIVAS 2004). The urediniospores of the type collection of *Uredopeltis chevalieri* are longer compared to any other cited collection (see above). The spectrum of sizes of teliospore crusts is as follows: 64–165 μm in diameter and 100–140 μm high (CUMMINS 1945: type collection of *Phakopsora grewiae*), 130–154 μm in diameter and 130–167 μm high (THIRUMALACHAR 1946: type collection of *Dasturella grewiae*), and up to 180 μm in diameter as well as in height (WALKER & SHIVAS 2004: type collection of *Uredopeltis chevalieri*). Given these size differences in both urediniospores and telia, the occurrence of the rust on different species of *Grewia* and its geographic distribution on three continents, we consider it possible, that *Uredopeltis chevalieri* has to be divided into different species. To address this question, all known specimens have to be included in morphological analyses to clarify their

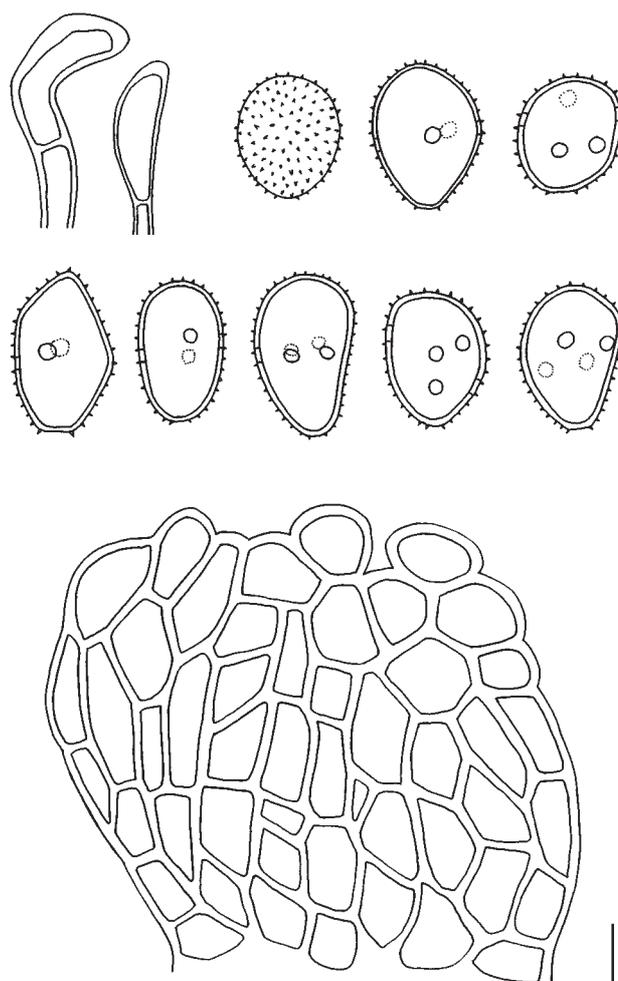


Fig. 23. *Uredopeltis* cf. *chevalieri* on *Grewia flavescens*. Paraphyses, urediniospores, and a teliospore crust (NA 264). Scale bar = 10 μm .

taxonomic relationships. *Grewia flavescens* seems to be a new host plant of *Uredopeltis* cf. *chevalieri*.

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