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A new circumscription of the genus *Xanthodactylon* (Teloschistaceae, lichenized ascomycetes)

Eine neue Umgrenzung der Gattung *Xanthodactylon* (Teloschistaceae, lichenizierte Ascomyceten)

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Key words: *Xanthodactylon, Xanthoria,* phylogeny, morphology, chemistry, distribution, Africa.

Schlagwörter: *Xanthodactylon, Xanthoria,* Phylogenie, Morphologie, Chemie, Verbreitung, Afrika.

Summary: The African genus *Xanthodactylon* is circumscribed and compared with the cosmopolitan genus *Xanthoria*. The two genera are best distinguished by their ascospores. The South African species *Xanthodactylon turbinatum* is shown to be heterogeneous. A new species *Xanthodactylon wirthii* is segregated and the new combination *X. alexanderbaai* is proposed. Four species are thus included in *Xanthodactylon*. In addition, African species of the genus *Xanthoria, X. sipmanii,* and the Afro-Eurasian *X. monofoliosa,* are described and illustrated. A key to the species of *Xanthodactylon* and morphologically similar species of *Xanthoria* is presented.

Zusammenfassung: Die afrikanische Gattung *Xanthodactylon* wird neu umgrenzt und mit der weit verbreiteten Gattung *Xanthoria* verglichen. Die beiden Gattungen sind vor allem durch unterschiedliche Ascosporentypen gut charakterisiert. Nach der Revision der vielgestaltigen südafrikanischen Art *Xanthodactylon turbinatum* wird die neue Art *Xanthodactylon wirthii* abgetrennt und die neue Kombination *Xanthodactylon alexanderbaai* vorgestellt. Dadurch umfaßt die Gattung *Xanthodactylon* vier Arten. *Xanthoria sipmanii* aus Afrika und *Xanthoria monofoliosa* aus Afrika und Eurasien werden beschrieben und illustriert. Die Arten der Gattung *Xanthodactylon* und morphologisch ähnliche Arten der Gattung *Xanthoria* werden geschlüsselt.

Introduction

Xanthorioid lichens of the southern hemisphere have been the focus of intense studies in recent years, resulting in the discovery of several new species and new delimitations of several genera (KONDRATYUK & KÄRNEFELT 1997, 2003; KÄRNEFELT et al. 2002; KONDRATYUK et al. 2004, 2007; EICHENBERGER et al. 2007). The discovery of new species is the result of recent collecting activities as well as morphological and chemical investigations of herbarium material.

Xanthodactylon was initially described as a monotypic genus (DUVIGNEAUD 1941). The type species, *X. perforatum* P. A. DUVIGN., was subsequently accompanied by two additional species circumscribed by DODGE (1971), namely *X. flammeum* (L. f.) C. W. DODGE and *X. turbinatum* (VAIN.) C. W. DODGE. However, KÄRNEFELT (1989) established that *X. perforatum* was a more recent synonym of *Lichen flammeus* L. f. and reiterated that the genus should be considered monotypic. More recently, the necessity for a separate genus to accomodate this species has been questioned (SCHERRER & HONEGGER 2003; SCHERRER et al. 2005). A comprehensive phylogenetic survey of the family Teloschistaceae, similar those for other large macrolichen families such as the Cladoniaceae, Parmeliaceae and Stereocaulaceae (BLANCO et al. 2006; MYLLYS et al. 2005; STENROOS et al. 2002; THELL et al. 2004), has yet to be completed. In the present study we have found that material labelled as *X. turbinata* included several undescribed species which are only distantly related to *X. turbinatum* s. str. despite their similar morphology.

The aim of this paper is to provide a new circumscription of the African genus *Xanthodactylon* P. A. DUVIGN. as well as the description of several new species. This is the fifth contribution towards a revision of the xanthorioid lichens in the southern hemisphere (KÄRNEFELT et al. 2002; KONDRATYUK et al. 2006; 2007).

Material and methods

Morphology was studied using an OLYMPUS stereo microscope and a digital camera with a DS-L1 Camera Control Unit. Anatomical characters, especially ascospores and spermatia were examined using a Zeiss microscope with an OLYMPUS DP-11 digital camera.

Results and discussion

Distinguishing characters of *Xanthodactylon*

Initially, *Xanthodactylon* was considered to be characterized by the cylindrical, slightly pulvinate, occasionally perforate lobes, covered by a rather thin, outer cortical layer (DUVIGNEAUD 1941; KÄRNEFELT 1989). DODGE (1971), had a

broader generic concept (with the genus comprising two species), and also accepted *X. turbinatum* with its broader, podetia-like stipes.

The type of ascospore present in xanthorioid lichens has been an underutilized character for segregating these taxa. *Xanthoria*-type ascospores are widespread among the genera *Xanthoria* TH. FR., *Caloplaca* TH. FR. and *Teloschistes* NORMAN. These ellipsoid ascospores are typically bipolar, characterized by thick septa in the equatorial zone, pressing the cell lumina tightly towards the poles. Such ascospores have been described in detail and their development discussed (HUE 1911; HILLMAN 1930; STEINER & PEVELING 1984).

According to DODGE (1971: 115-116), *Xanthodactylon* has 'ascospores with a relatively thin septum without a visible pore', and for *X. turbinatum* he added 'protoplasts 4 µm in diameter at first, becoming larger at the septum, thin at maturity'. In the present study, this thickening of the spore wall was observed at both the equator and the poles in species of *Xanthodactylon*. When mature, *Xanthodactylon*-type ascospores have onion-shaped cell lumina towards the equatorial zone. Young ascospores have cell walls of uniform thickness (Figs. 1-2).

The mode of attachment is an important character for xanthorioid lichens (GIRALT et al. 1993; KONDRATYUK & POELT 1997; KONDRATYUK & KÄRNEFELT 1997, 2003). Different types of attachments have been observed, including true hapters in *Xanthoria parietina*, a thick, massive holdfast in *Xanthomendoza mendozae*, thick rhizines in the *Xanthoria ulophyllodes* group and very thin rhizines in *Josefpoeltia* (as illustrated in KONDRATYUK & POELT 1997; KONDRATYUK & KÄRNEFELT 1997, 2003). Species of *Xanthodactylon* have very short, furcate, rhizines which usually form a dense brush along the lobe margins; these are referred to as *Xanthodactylon*-type rhizines in the present work. However, such rhizines are known from additional southern hemisphere xanthorioid lichens, including the *Xanthoria elixii* group *(X. filsonii, X. elixii, X. dissectula)* and in the African species, *Xanthoria karrooensis*.

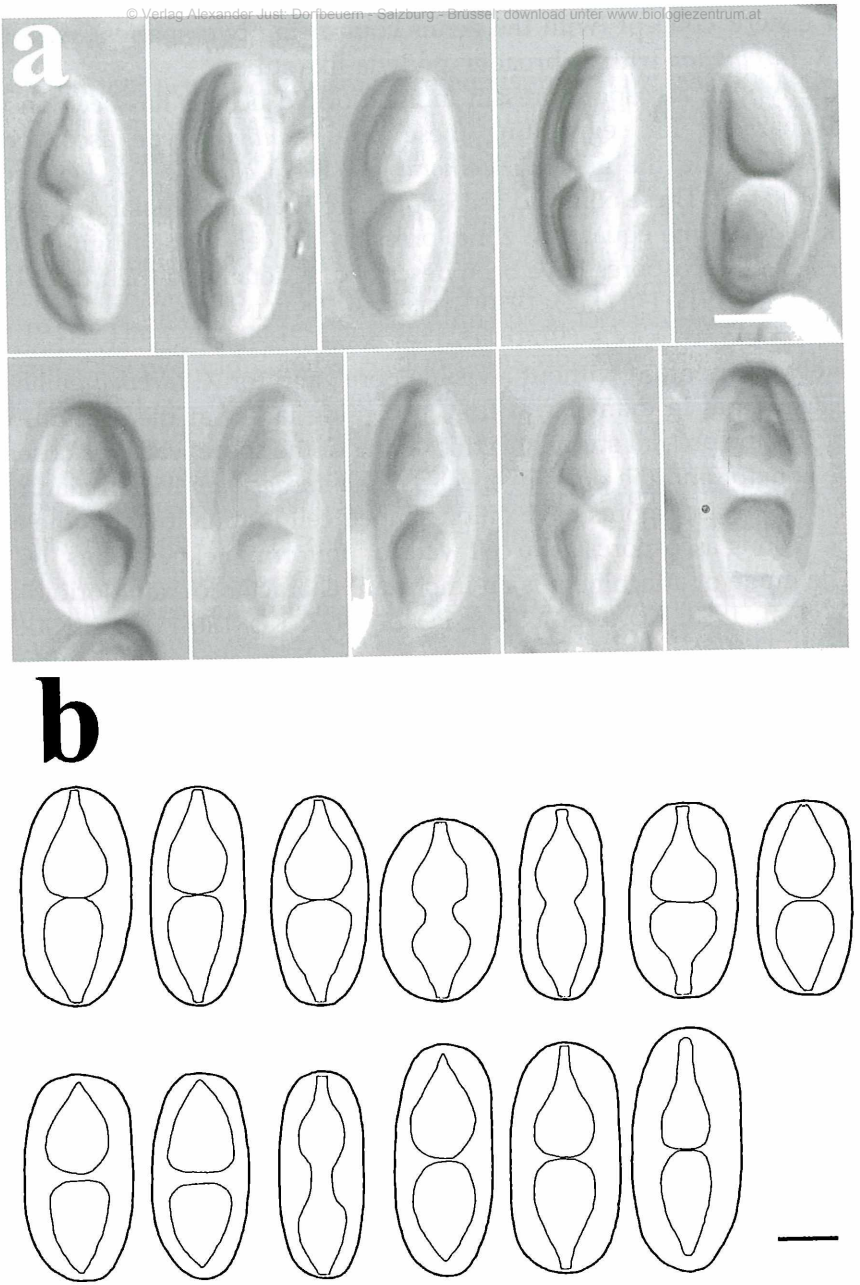

Fig. 1: Ascospores of *Xanthodactylon* type: a) ascospores of *X. turbinatum* in water (MATTICK 10, LD); b) ascospores of *X. alexanderbaai* in K (ALMBORN & KÄRNEFELT 8414-17, LD); scale bar = 5 µm.

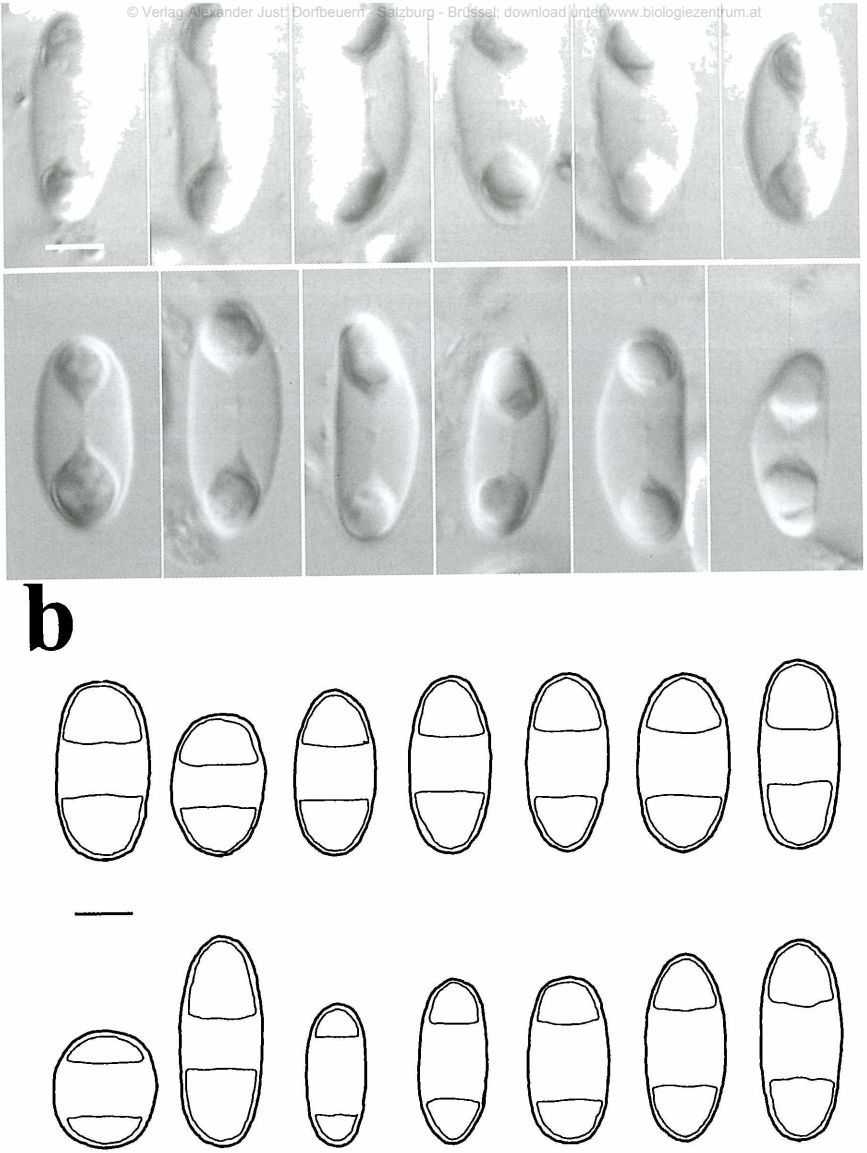

Fig. 2: Ascospores of *Xanthoria* type: a) Ascospores of *X. inflata* in K (FEUERER & THELL 63030b, HBG), b) ascospores of *Xanthoria sipmanii* in K (ALMBORN 4896, LD).

Xanthodactylon wirthii S. KONDR. & KÄRNEFELT sp. nova (Fig. 3)

A simili *X. turbinata* differt thallo lucidiore, lobis solidis et ascosporis minoribus.

Type: South Africa, Western Cape: Cape Agulhas, Bredasdorp Div., Frikkies Baai, on twigs, 30.iv.1946, RAND 314c (LD – holotype, BOL – isotype); RAND 312 b – topotype (KW).

Thallus 3-5 cm in diam., forming regular rosettes, closely attached to the substrate. Upper surface bright, almost lemon-yellow, but appearing brownish-yellow towards the centre due to the numerous apothecia. Lobes 6-7 mm long, (0.5-)1.0-2.5 mm wide, irregularly branched; secondary lobes 1-2 mm long, (0.6-)1-1.5(-2.0) mm wide, dissected at the tips; total lobe width (including secondary lobes) up to 5 mm wide, 75-100 µm thick; compact, subconvex due to inrolled margins. Rhizines of the Xanthodactylon type, 50-75 µm in diam., ca. 0.4-0.5 mm long, often in groups along the margins.

Apothecia 0.7-2.2 mm in diam., to 0.3-0.7(-1.0) mm high, initially immersed in warts, lecanorine, becoming pronounced, cup- or barrel-like, very large and biatorine on short, narrow stipes with a thick thalline margin; margin 0.2 mm wide, concolorous with the thallus, yellow to slightly brownish-yellow, rising well above the level of the disc, persistent or becoming excluded; disc slightly darker, intense orange-brown to dull brownish-yellow, usually flat, rarely becoming subconvex when overmature. Hymenium 50-55 µm high; paraphyses frequently branched in the uppermost part; subhymenium 10-15 µm thick. Asci 8-spored. Ascospores *Xanthodactylon*-type, rather short and wide, (10-)11-13(-14) x (5-)6-8 µm in water, 12-15 x (7-)8-9 µm in K, septum 1-2(-4) µm thick in water, 2-3 µm thick in K.

Chemistry: parietin (major), parietinic acid (minor/trace), fallacinal (trace), teloschistin (minor/trace).

Ecology: *Xanthodactylon wirthii* usually grows on bark of trees and shrubs, but has been observed on rock at one locality. It is associated with various crustose epiphytic lichens, as well as various foliose species including *X. alexanderbaai*, members of the *Xanthoria parietina* (L.) TH. FR. group, and occasionally *Leptogium* spp. and liverworts.

Distribution: The new species is known only from the area around Bredasdorp in the southernmost part of Western Cape Province, South Africa.

Etymology: The new species is named in honour of Prof. Volkmar WIRTH, one of the world's more prominent lichenologists and to whom this study is dedicated.

Notes: The very adnate thalli of *X. wirthii* form an almost continuous surface over the substrate in the central parts. The closely attached lobes are reminiscent of those of *X. turbinatum*, but *X. wirthii* differs in having smaller ascospores which barely expand after treatment with K. In addition, *X. wirthii* differs

from both X. *turbinatum* and X. *alexanderbaai* (a second closely related species), by its very compact and much brighter yellow lobes. By comparison with X. *alexanderbaai*, the lobes of X. *wirthii* are thicker and its true exciple is considerably thinner in the upper lateral parts. The compact lobes of X. *wirthii* have a subconvex appearance because of the inrolled margins, a character present in the *Xanthoria ligulata* group as well. The lobes of *Xanthodactylon alexanderbaai* are suberect and not closely attached like those of X. *wirthii.*

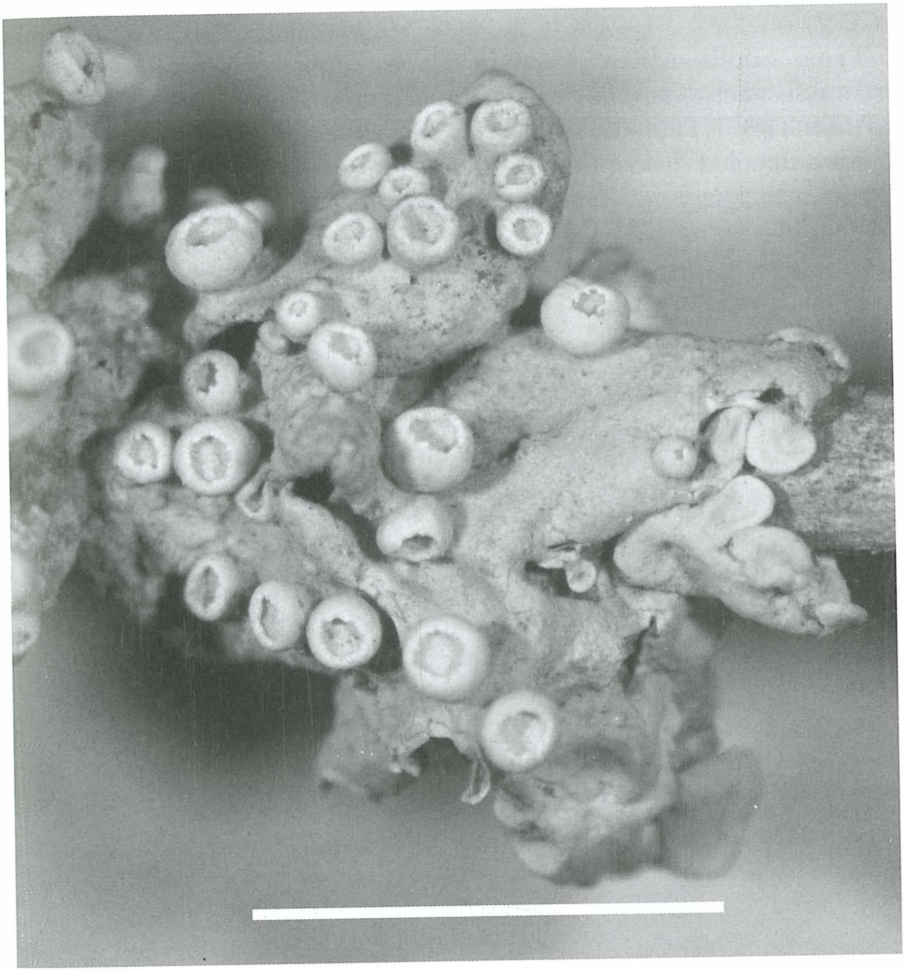

Fig. 3: Habit of *Xanthodactylon wirthii* (holotype); scale bar = 5 mm.

Additional specimens examined: South Africa, Western Cape: Bredasdorp Div., Arniston, scrub near the sea, growing together with X. *alexanderbaai*, 25.ix.1956, LEIGHTON 3345 (LD); Bredasdorp, on bark, 31.vii.1946, RAND 317b (LD); Caledon Div., Iaus [?] Kraal, in scrub near the sea, growing together with

X. alexanderbaai, 21.iv.1946, LEIGHTON 1705 (LD); N side of Danger Point, growing together with *X. alexanderbaai* and *Xanthoria parietina* aggr., 21.i.1946, LEIGHTON 1547 (LD); Danger Point, on rocks near the sea, 21.i.1946, Leighton 1546 (LD).

Xanthodactylon alexanderbaai (S. KONDR. & KÄRNEFELT) S. KONDR. & KÄRNEFELT comb. nova (Fig. 1b, 4)

Basionym: *Xanthoria alexanderbaai* S. KONDR. & KÄRNEFELT, Lichenologist **33**: 9 (2002).

Type: South Africa, Western Cape: Südlich Alexanderbay, an der Hauptstrasse nach Namibia, wenig südlich der Grenze, flache Hügel, 65 m, 2001, A. THELL & T. FEUERER 60487b (LD – holotype, HBG – isotype).

For a detailed description of the species, see KÄRNEFELT et al. (2002). *Xanthodactylon alexanderbaai* differs from all *Xanthoria* species by its variable lobe thickness, the scleroplectenchymatous tissue in the upper cortex of the thallus which is less conglutinated in the true exciple, the bacilliform spermatia and the absence of any type of attachment to the substrate.

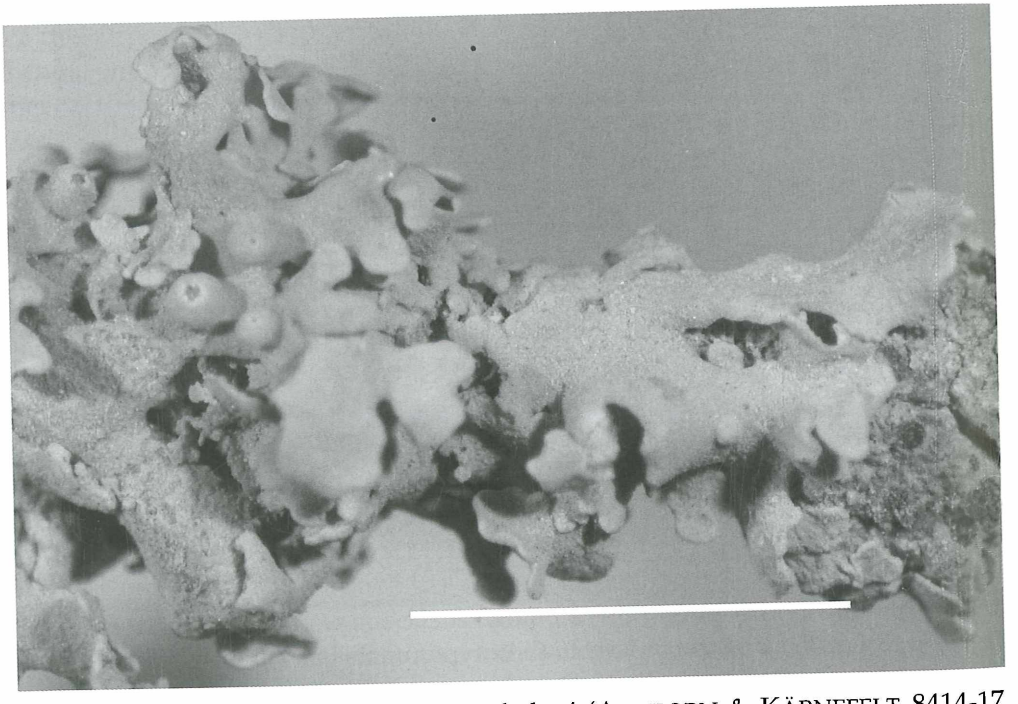

Fig. 4: Habit of *Xanthodactylon alexanderbaai* (ALMBORN & KÄRNEFELT 8414-17, LD); scale bar = 5 mm.

Chemistry: parietin (major), parietinic acid (minor), fallacinal (trace), teloschistin (trace).

Notes: In the original description, *Xanthodactylon alexanderbaai* was only cited from three localities. After examination of extensive South African collections, it was found to be the most widely distributed representative of the genus (see also citation of its occurrence together with *X. wirthii*, *X. turbinatum* and species of *Xanthoria* treated in this paper).

Xanthoria inflata EICHENBERGER, APTROOT & HONEGGER, Lichenologist **39**(5): 455 (2007) (Figs. 2a, 5)

Typus: South Africa, Western Cape: Lamberts Bay, epiphytic, 3 September 2006, D. J. SUPTHUT 483 I (Z+ZT—holotypus, not seen).

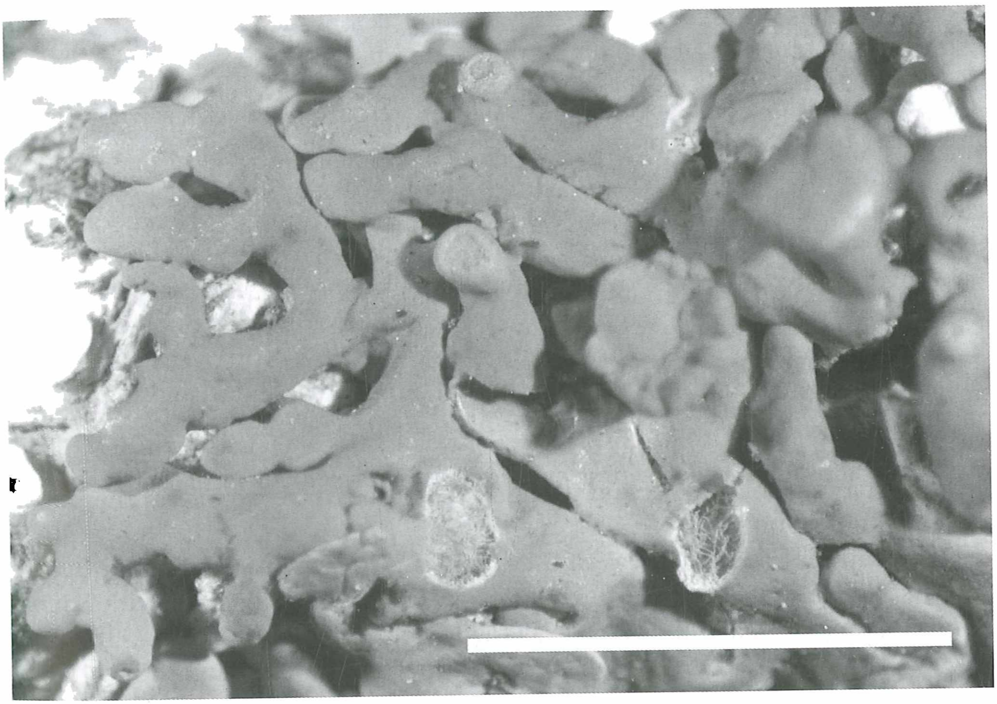

Fig. 5: Habit of *Xanthoria inflata* (FEUERER & THELL 63030b, HBG); scale bar = 4 µm.

Thallus 3-4 cm in diam. Upper surface shiny, bright yellow towards the peripheral zone or greenish-yellow to greenish when growing in shaded habitats, appearing dark brownish-orange or dull brownish-orange towards the centre due to the numerous apothecia. Lobes tube-like, very convex from the base

to the tips, 4-5 mm long or occasionally to 10 mm long, 1.0-1.5 mm wide, straight or irregularly twisted, contiguous, frequently exposing a naked reddish to dull or dirty reddish-violet medulla.

Apothecia 0.7-2.2 mm in diam., lecanorine, with a hollow stipe, plane to convex or becoming very convex when overmature, thalline margin dull greenish-yellow, to dull yellow or yellowish-brown to brownish-yellow, much paler than the thallus and disc; disc almost concolorous with the thallus. Hymenium 50-60 µm high; subhymenium 20-30 µm thick; paraphyses branched and slightly widened to 4(-5) µm diam. towards the tips. Asci 8-spored. Ascospores of *Xanthoria*-type, small, narrowly ellipsoid with attenuated ends, with cell lumina somewhat rounded at the poles, 8-13(-15) x (4-)5-6(-8) µm in water [(10-)12-18 (-19) x (4-)5-9(-11) µm in K], septum (2-)3-7(-8) µm thick in water [(3-)4-8(-11) µm thick in K].

Chemistry: parietin (major), parietinic acid (minor), fallacinal (minor), teloschistin (minor).

Ecology: *Xanthoria inflata* grows on twigs of various shrubs.

Distribution: This species is known only from South Africa where it has previously been overlooked.

Notes: *Xanthoria inflata* is morphologically similar to *Xanthodactylon turbinatum*, with both species being characterized by horizontally oriented, convex, hollow lobes and the pronounced, stipitate apothecia. However, this species is distinguished by the markedly convex, tube-like, hollow lobes, which never become compact. It is characterized by the orange or dull brick orange medulla, the usually shiny, bright yellowish to greenish-yellow upper surface, the lecanorine apothecia and the *Xanthoria*-type of ascospores. The lecanorine apothecia and the *Xanthoria*-type ascospores also distinguish *Xanthoria inflata* from *Xanthodactylon alexanderbaai*. In addition, *X. alexanderbaai* differs from *Xanthoria inflata* by having solid lobes and a poorly developed true exciple in the uppermost lateral portion.

Additional specimens examined: South Africa, Western Cape Province. Rocherspan National Park, nördlich Veldrif, 5 m, growing together with *Xanthodactylon alexanderbaai*, 24.iii.2001, T. FEUERER & A. THELL (63030b – HBG, LD, KW; 63042 – KW; 63069 – HBG). Kapteinskloof, in the churchyard area in the southern part of the village Sauer, 24.iii.2001, FEUERER 60476 & THELL (HBG); Rocherspan National Park N of Veldrif, growing together with *Xanthoria wirthii* and *X.* sp., 24.iii.2001, FEUERER 63048 & THELL (HBG); distr. Namaqualand, Hondeklip Bay, on dead shrubs in dunes near the sea, growing together with *Xanthodactylon flammeum*, 14.ix.1953, ALMBORN 4678 (LD); growing together with *Xanthodactylon alexanderbaai* and *X. flammeum*, 14.ix.1953, ALMBORN 4679 (LD, KW ex. ALMBORN, Lichenes africani, No. 23); growing together with *Xanthodactylon flammeum*, 14.ix.1953, ALMBORN 4678 (LD); Div. Paarl, Hercules Pillar, Toostenbeng, Hats north of the hill, 20.9.1944, LEIGHTON 562 (LD); Malwes-

bury Div., Near Langeenheid, between Langebaan Road and Vaadenburg, growing together with *Xanthodactylon alexanderbaai* and *Xanthoria dissectula*, 1.ix.1944, LEIGHTON 525 (LD, KW); Hopefult [?], on *Prunus gravalum*, iv.1923, v.d. BYL 395 (LD ex BOL).

Xanthoria monofoliosa S. KONDR. & KÄRNEFELT sp. nova (Fig. 6)

A simili *X. parietina* differt thallo laxo, lobis longioribus undulatis, appendicibus ciliformibus sparsis, medullae fasciculis scleroplectenchymaticis et ascosporis multo angustioribus.

Thallus (1.2-)1.5-2.0 cm wide, up to 80-90 µm thick, usually in large aggregations, the centre of each thallus appearing to form a continuous surface despite it being composed of separate lobes. Upper surface dull yellow or greenish-yellow to slightly brownish, yellowish-orange or whitish-yellow when growing in shaded conditions. Lobes overlapping, forming a very lax multilayered network, 2.0-2.5(-5.0) mm thick, individual lobes thin and strap-shaped, attached at a single basal point, to 7-8(-12) mm long, (0.2-)0.5-1.0(-1.5) mm wide at the base, gradually broadening and richly branched towards the tips, up to (0.7-)2-4 mm wide, rounded, flat to subconcave with a rim on the upper side; apical secondary lobes 2.5-4.0 mm long, 2-3 mm wide; the total width of a single lobe (including secondary lobes) to 5-7(-9) mm. Lower surface white, with numerous veins, wrinkled, uneven, yellowish or whitish-yellow. Rhizines absent, but cilia-like appendages frequently present along the margin, simple or branched 2-3 times at the base, ca. 60-125 µm wide, gradually tapered towards the tips, usually not furcate, to 0.2(-0.7) mm long, white or yellowish. Upper cortex (7-)10-15 µm thick, palisade paraplectenchymatous; algal zone to 40 µm thick. Medulla to 50-60 µm thick, often with 30-45 µm thick scleropletenchymatous bundles. Lower cortex mesodermatous paraplectenchymatous, to 20 µm thick.

Apothecia 0.5-1.7 mm diam., lecanorine, zeorine in cross section, flat, distinctly stipitate, with a fairly thin, well developed and pronounced thalline margin, up to 75 µm thick, with an attenuated base; disc flat to convex when overmature, slightly darker than the thallus, dark or bright orange. Hymenium to 60-70 µm high; subhymenium 15-20 µm thick; paraphyses swollen towards the tips, to 5-6 µm diam. *Asci* usually with 5-6 well developed ascospores. Ascospores of *Xanthoria*-type,. often with spherical lumina, (6-)7-13(-15) x 5-7(-8) µm in water [(8-)9-15(-16) x (5-)6-8(-9) µm in K], septum (3-)4-9(-12) µm in water [(3-)5-9(-12) µm in K]. Spermatia rare, juvenile, ellipsoid to bacilliform.

Ecology: This species usually occurs on bark of trunks or twigs but was collected once on concrete.

Distribution: *Xanthoria monofoliosa* is known from South Africa, the Canary Islands, the Mediterranean region in Europe and the Middle East.

Notes: The majority of specimens identified as *Xanthoria parietina* from Western Cape Province refer to *X. monofoliosa*. The remaining specimens of *X. parietina* sens. lat. from this region are in urgent need of revision. The modes of attachment and structure of the thalli are strikingly different in *X. monofoliosa* and *X. parietina*, in that *X. monofoliosa* does not form rosette-like thalli with an entire central surface. This is particularly noticeable in young thalli, where each individual lobe is attached to the substrate at a single, basal point, particularly on thin twigs, where the single-point attachment of the pendant lobes is spectacular. By contrast, the lobes of *X. parietina* are attached by hapters. *X. monofoliosa* has rhizine-like cilia along the lobe margins, but these appear to have a different function, namely to keep the long, very thin lobes tightly contiguous and forming a network-like, lax thallus. This typical growth habit (i.e. not forming a well developed central surface of the thallus), also distinguishes *X. monofoliosa* from the morphologically similar Australian species, *X. coomae* S. KONDR. & KÄRNEFELT (KONDRATYUK et al. 2007). Furthermore, *X. monofoliosa* has shorter and narrower ascospores than both *X. coomae* and *X. parietina*.

Xanthoria microspora DE LESD. from Israel and Sinai in Egypt should also be considered when discussing *X. monofoliosa*. Unfortunately, *X. microspora* is represented by a very poor type specimen and is in need of revision (KONDRATYUK et al. 2004). Nonetheless, *X. monofoliosa* differs from *X. microspora* in having a much larger thallus (1.5-2.0 cm vs. 0.8-2.0 mm wide), longer and wider lobes (7-12 mm long, 5-7 mm wide vs. 4-5 mm long, 2.5-3.5 mm wide), a higher hymenium (60-70 µm vs. 30-40 µm), larger ascospores (8-16 x 5-9 µm vs. 7.6-9.5 x 4.2-5.7 µm) and broader septa (3-12 µm vs. 3.8-5.7 µm).

Additional specimens examined: South Africa, Western Cape Province. Division of Cape, Bloubergstrand, on shrubs along the shore, growing together with *Xanthoria* sp., 24.i.1984, Almborn & Kärnefelt 8441 (LD); Bloubergstrand, on shrubs along the shore, 24.i.1984, ALMBORN & KÄRNEFELT 8448 (LD); Table Mountain, 1887 P. MACOWAN 334 (LD); Division of Malmesbury, Saldanha, on shrubs, 24.i.1984, ALMBORN & KÄRNEFELT 84634 (LD); 84635 (BOLUS); 84636 (KW); 84637 (UPS); Div. George, The Wilderness, on dead twigs, glade edge, nature reserve, 25.xi.1962, Kofler 1 (LD); Hermanus, ii.1920, Joseph Burtt-Davy 18520 (LD); Frikkies Baai. Bredasdorp Div., 30.vii.1946, Rand 320 (LD); east of Veldrif, 24.iii.2001, FEUERER 63003 & THELL (HBG); Table Mountain, ledges on western side, on bark, 2000-2500 ft, 26.x.1953 E. ESTERHUYSEN (LD ex BOL 20685). Spain, Canary Islands, Hierro, Municipio Val Verde, on *Cupressus macrocarpa*, alt. 720 m, 28.vii.1987, FEUERER 26597 (HBG). Israel, Shefela: Beit Gubrin, on *Rhamnus palaestina*, 5.ii.1969, WARBURG (LD). Cyprus, Agia Napa, c. 500 m east of Nissi Beach, on *Sarcopoterium spinosum*, 20.iii.1996, THELL AT00196 (LD).

Greece, Rhodos, Filerinos Mt, on *Populus*, alt. 275 m., 18.x.1968, Alkanis (LD); Rhodos, Kalamora, on *Populus*, 18.x.1968, Alkanis (LD).

Fig. 6: Habit of *Xanthoria monofoliosa* (holotype); scale bar = 2 mm.

The lax thallus of *Xanthoria monofoliosa* is reminiscent of the South African *Xanthodactylon alexanderbaai* and the European *Xanthoria ectaneoides* (NYL.) ZAHLBR. In addition to the different ascospore-types, *Xanthoria monofoliosa* is distinguished from *Xanthodactylon alexanderbaai* by having wider, pendant lobes, whereas *Xanthoria ectaneoides* has fewer, narrow, separate lobes that remain independent and do not form a dense, contiguous thallus typical of *X. monofoliosa*.

Xanthoria sipmanii S. KONDR. & KÄRNEFELT sp. nova (Figs. 2b, 7)

A simili *X. turbinato* differt lobis non convexis et ascoporis typo Xanthoriae.

Type: Namibia, Omaruru District, 2114 CC. Lagunenberg mountain, NE of Mile 72, extremely rich lichen vegetation on rocks and on scattered succulent

shrubs on the mountain slopes, 08.i.1986, I. KÄRNEFELT 8605-45 (LD – holotype), 8605-43 (BOL – isotype), 8605-44 (KW – isotype), 8605-46 (B – isotype).

Thallus 2-4 cm wide, 200-220 µm thick. Upper surface dark reddish-orange or brownish -orange, dark reddish-violet towards the centre due to the numerous spermogonia, paler yellowish-orange at the periphery. Lobes flat from the centre to the tips but ± convex at the base, 6-7 mm long, 0.5-1 mm wide, but 1-1.5 mm wide at the branching nodes and towards the tips, radiating, very sturdy, margins folded downwards. Upper cortex rather thin, 7-10 µm thick, cells almost rounded to 4 µm diam. Algal zone 50-60 µm thick, continuous, medulla from 60-70 µm thick to 80 µm thick when hollow, composed of thick scleropletenchymatous bundles 30-40 µm in diam., or of separate hyphae. Lower cortex 10-20 µm thick, paraplectenchymatous in parts but mainly scleroplectenchymatous. Terminal portions of lobes usually narrow (ca. 0.5-1.0 mm wide) and more closely attached to the substrate than in central part. Lower surface yellowish-orange or brownish-orange, exhibiting small veins. Rhizines of *Xanthodactylon*-type.

Apothecia numerous, 0.5-1.7 mm diam., zeorine in section, pedicellate, attenuated at the base, usually not barrel-shaped but young apothecia sometimes immersed in warts; young apothecia slightly paler at the margins, covered by a thin, yellowish pruina; disc reddish-violet to brownish-violet; thalline margin pale yellowish-orange to brownish-orange, sometimes very thick, 0.10-0.25 mm wide, somewhat crenulate when older. Hymenium 65-75 µm high, subhymenium 10-20 µm thick; paraphyses unbranched, 1.5-2.0 µm diam., slightly widened towards the tips, to 3-4 µm diam., oil cells and oil droplets not seen. *Asci* 8-spored. Ascospores of *Xanthoria*-type, of uniform size within and outside the asci, from almost spherical to elongate ellipsoid, (8-)9-12 x 5-7(-8) µm in water [(8-)10-12(-14) x (5-)6-8 µm in K], septum 3-5(-6) µm thick in water [slightly wider, (3-)4-7 µm in K].

Chemistry: parietin (major), parietinic acid (minor), fallacinal (minor), teloschistin (trace).

Ecology: *Xanthoria sipmanii* occurs on rocks.

Distribution: This new species is known from scattered localities of southern Africa.

Etymology: The species is named in honour of the Dutch lichenologist Harrie Sipman, for his many contributions to tropical and southern hemisphere lichenology.

Notes: The lobes of *Xanthoria sipmanii* appear subconvex, but never form tube-like structures like those of *Xanthodactylon flammeum*, *X. turbinatum* and *Xanthoria inflata*. To some extent, the new species resembles an epilithic form of *X. turbinatum*, despite the fact that the lobes are not hollow or flat towards the tips.

Additional specimens examined: Namibia, distr. Omaruru, ca. 2 km N of Cape Cross, 9.i.1986, SIPMAN 19728 (B-53338). South Africa, Western Cape Province: Distr. Vanrhynsdorp, 2 miles N of Nieuwe Rust, 16.ix.1953, ALMBORN 4896 (LD).

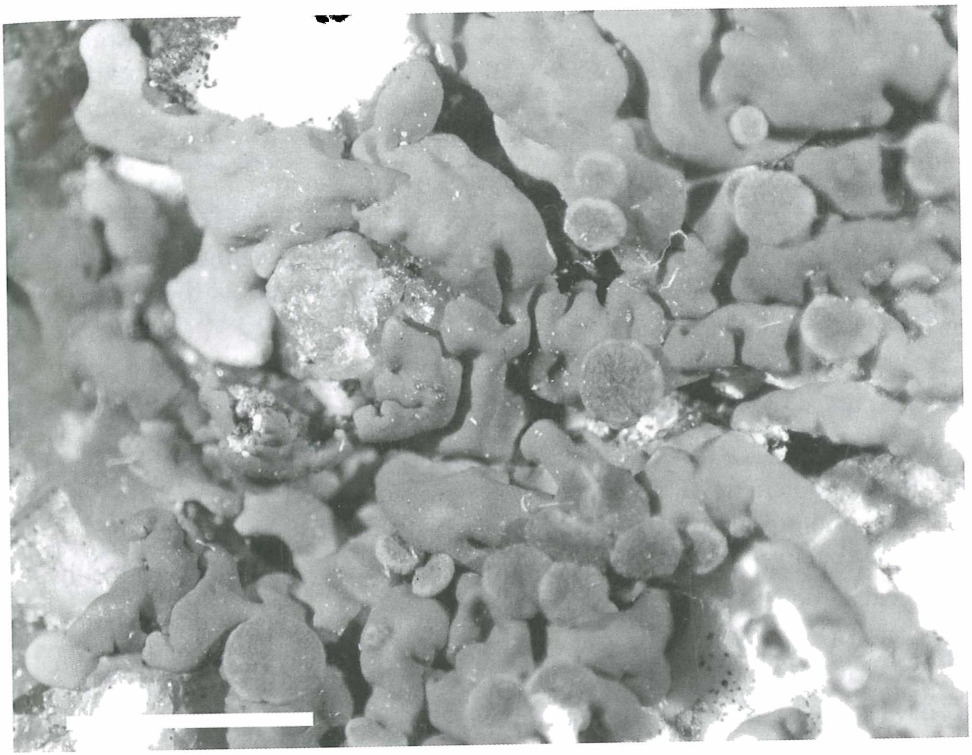

Fig. 7: Habit of *Xanthoria sipmanii* (holotype); scale bar = 2 mm.

Key to the species of *Xanthodactylon* and morphologically similar *Xanthoria* species

1 Lobes with a distinctly hollow medulla 2
– Lobes with compact medulla, appearing convex (see also *Xanthoria sipmanii)* 4

2 Lobes vertically orientated; podetia-like ..... ***Xanthodactylon flammeum***
– Lobes horizontally orientated; vertically orientated stipa present 3

3 Lobes compact and flat or becoming subconvex towards the tips; spores of *Xanthodactylon*-type ..... ***Xanthodactylon turbinatum***
– Lobes hollow and tube-like to the tips, very thick; spores of *Xanthoria*-type.....
..... ***Xanthoria inflata***

4 Thallus saxicolous; lobes subconvex, edges folded downwards; spores of *Xanthoria*-type ..... ***Xanthoria sipmanii***

– Thallus corticolous; lobes plane or subconvex; spores of *Xanthodactylon*-type 5

5 Lobes flat, thin, often semi-erect, forming a lax thallus, variegated in colour ... . ***Xanthodactylon alexanderbaai***

Lobes subconvex, firmly attached to the substrate, brightly yellow to citrine yellow ..... ***Xanthodactylon wirthii***

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