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Lecidelletum crystallinae, a lichen community on gypsum crusts of the Namib Desert including the new species *Buellia sipmanii*

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Abstract: A new lichen community, the Lecidelletum crystallinae ass. nova, is described here. It occurs on gypsum crusts in the Namib Desert, an almost rainless coastal fog region of southwest Africa. In addition to *Lecidella crystallina,* the community is also characterized by *Caloplaca volkii* and *Buellia sipmanii* Bungartz & Wirth sp. nova. Although widespread throughout the Namib, the new association only occurs in reach of the coastal fogs.

Key words: lichen community, *Buellia,* gypsum, Namib Desert

Zusammenfassung: Das Lecidelletum crystallinae, eine Gips-bewohnende Flechtengesellschaft der Namibwüste mit der neuen Art *Buellia sipmanii*.

Eine meist von *Lecidella crystallina* beherrschte Flechtengemeinschaft, das Lecidelletum crystallinae ass. nova, wird hier beschrieben. Sie kommt auf Gipskrusten in extrem niederschlagsarmen Regionen Südwestafrikas vor. Charakterarten sind neben *Lecidella crystallina*, *Caloplaca volkii* und *Buellia sipmanii* Bungartz & Wirth sp.nov. Die Flechtengesellschaft ist in der Namibwüste in Reichweite der Küstennebel weit verbreitet.

Introduction

Phytosociological studies require extensive knowledge of species, particularly in the field. Such knowledge is often lacking for tropical and subtropical regions, hence lichen associations have seldom been described from these areas. The few exceptions frequently do not conform to standards established for phyto-sociologial analyses in Europe, which are based on detailed relevés with complete species lists and individual abundance ratings for each species. In this respect, southwest Africa and the Namib Desert are no exception. Although large collections of lichens from the Namib Desert are available for study, until recently

most important elements of the lichen vegetation were insufficiently known or remained undescribed. Nevertheless, some attempts have been made to classify the lichen vegetation of the Namib Desert using phytosociological methods (MATTICK 1970, JÜRGENS & NIEBEL-LOHMANN 1995). These efforts have been limited to visually striking communities dominated by *Teloschistes* spp. in the coastal regions. Due to insufficient taxonomic knowledge of the crustose species, relevés of these preliminary studies remain incomplete. Until recently several taxa from difficult species groups still remained unidentified (e.g. the *Xanthoparmelia serusiauxii*-group and the "*Neofuscelia*" *namibiensis*-group). Even species represented by a high abundance were often only determined to genus level or sometimes not identified at all.

The lichen association described here is widespread throughout the Namib Desert; it is typically encountered on, and possibly confined to, gypsum crusts. Despite this obvious habitat preference for gypsum, all characteristic species of the association were previously undescribed. Searching the literature, no descriptions of species typical for this community have been found. In the 1970s, the first author and a colleague described two characteristic species as new: *Lecidella crystallina* V. WIRTH & VĚZDA and *Caloplaca volkii* V. WIRTH & VĚZDA (WIRTH & VĚZDA 1977). A further species, *Buellia sipmanii*, is described herewith. Another characteristic element is a yellow *Acarospora* species, which currently remains undescribed. It is referred to here as *A.* "*gypsi-deserti*" ad interim since Magnusson's treatment of South African *Acarospora* excludes this species (MAGNUSSON 1933).

Crusts of gypsum and thus the Lecidelletum crystallinae are irregularly distributed across gravel plains of the central Namib. They are also found on foothills and below rocky mountain ridges, where they typically occur at the base of weakly inclined slopes on stabilized sand and in the presence of the gypsum, hardened into a crust. These crusts have a cemented surface and typically cover areas up to a square metre. Below the ground level, many of these crusts appear connected; they typically occur as a patchwork of closely neighbouring plots. The occurrence of the cemented gypsum patches is associated with coastal fogs, reaching inland to no more than 30 km from the sea. The origin of the gypsum crusts is directly related to H_2S released from the ocean which reacts with atmospheric oxygen to form sulphate; the latter is transported inland by the coastal fog where it is deposited and, in the presence of calcium carbonate and water, transformed into gypsum (GRÜNERT 2003).

Lecidelletum crystallinae, ass. nov.

The lichen flora associated with gypsum crusts of the Namib Desert is fairly uniform: characteristic species are *Lecidella crystallina, Caloplaca volkii, Buellia sipmanii* and *Acarospora "gypsi-deserti"*. The first two species frequently peel off from their substrate, forming crustose fragments several centimetres in diameter. These fragments become vagrant members of other lichen communities on the coastal gravel plains. They are especially characteristic in communities with *Teloschistes capensis* and *Xanthoparmelia walteri*, where the crusts are mixed with pebbles and other vagrant species such as *Caloplaca testudinea* and *C. namibensis* (WIRTH et al. 2007). In both of the latter species, gypsum crystals

form a distinct pruina on the thallus surface as well as being embedded throughout both the cortex and the medulla (WIRTH & VĚZDA 1975).

The lichens associated with gypsum can be assigned to one single community. The ecological conditions appear rather uniform: the amount of water precipitation from coastal fog is fairly consistent and the only environmental factor that may vary considerably is the presence of gypsum in the soil. Species such as *Teloschistes capensis* or *Heterodermia namaqua*, which are occasionally also present in low frequencies, may indicate slightly higher water availability from the condensation of fog. Generally, however, the gypsum community is less common at both very moist and reasonable arid extremes. It is best developed at sites with intermediate humidity. In addition to the previously mentioned characteristic species, the following can frequently be observed: *Lecidea sarcogynoides/capensis*, *Santessonia sorediata* and *Xanthoria turbinata*. With the exception of *Xanthoparmelia walteri*, species of *Xanthoparmelia* are absent from the gypsum community even though the genus is generally widespread, species-rich and typically very abundant in Namibia.

Lecidella crystallina, the most characteristic element of the new lichen association, is universally found on gypsum crusts of the central Namib Desert. Another typical, but less abundant associated species is *Caloplaca volkii*, which appears to be better adapted to large gypsum patches; in the field, sterile thalli can be very similar to *Lecidella crystallina*, and therefore not easily distinguished. *Buellia sipmanii* occurs in less abundance, and the least frequent associated species is *Acarospora "gypsum-deserti*", which rarely covers more than 2% of the relevés. Sandstorms often have a conspicuous effect on these crusts, the surface of the species frequently being eroded from their abrasive force.

Buellia sipmanii **Bungartz & V. Wirth, sp. nov.**

> *B. dispersa* et *B. nashii* similis sed ascosporae subglobosae parietibus profundibus, epihymenium aeruginosum, thallus xanthonicum continens.

Type: NAMIBIA. Between Swakopmund and Hentiesbai, 9-10 km NNE of Wlotzkasbaken, c. 7 km E of the coastal road C 34; 22°20'04''S, 14°29'19'' E, 90 m; X. 2001, V. Wirth 43119 [KR holotype].

(Fig. 1)

Thallus crustose, thick, continuous or becoming dispersed, epilithic, areolate to bullate, becoming subsquamulose; *prothallus* absent; thallus surface matt, greyish-white to beige, rarely grey, finely pruinose, phenocorticate; entire thallus filled with an abundance of calcium oxalate (H_2SO_4+ forming clusters of needle sharp crystals).

Apothecia lecideine, (0.3-)1.0-1.5(-2.0) mm in diam., soon sessile; proper margin black, thin to moderatey thickened, usually persistent, rarely excluded with age; disk black, pruinose, plane usually becoming strongly convex with age. Proper exciple of the *dispersa*-type *sensu* SCHEIDEGGER (1993), i.e. inner excipular hyphae distinct not reduced, pigmented, prosoplectenchymatous (*textura oblita*), extending from the deep reddish-brown hypothecium (*leptoclinoides*-brown, *textura intricata*), outer excipular hyphae short-celled, cells angular, distinctly swollen *(textura angularis*) and strongly carbonized, blue-

green from high concentrations of an aeruginose pigment (*cinereorufa*-green, HNO_3+ violet), pigmentation continuous with the epihymenium; hymenium hyaline, not inspersed; paraphyses simple to moderately branched, apically swollen, with an aeruginose pigment cap (*cinereorufa*-green) and a diffuse aeruginose pigment (HNO_3+ violet, *cinereorufa*-green). *Asci* 8-spored, clavate, *Bacidia*-type. *Ascospores* broadly ellipsoid to almost globose, never constricted, with obtuse ends, not curved, (10.0-)10.6-12.9(-14.0) [mean 11.8] × (7.0-)8.3-9.5(-10.0) [mean 8,9] µm; 1-septate, proper septum soon but only briefly thickened during spore ontogeny, wall evenly thickened in premature spores (± *Physconia*-type); ornamentation absent (not visibile in DIC).

Pycnidia infrequent, globose, unilocular, at maturity almost entirely occupied by densely branched conidiophores; conidiogenous cells mosty terminal, rarely also intercalary (cf conidiophore type V *sensu* VOBIS 1980, VOBIS & HAWKSWORTH 1981); pycnidial ontogeny similar to *Umbilicaria*-type (sensu VOBIS 1980, VOBIS & HAWKSWORTH 1981); conidia simple, bacilliform, 3.0-5.5 × 1.0-1.5 µm (n=20).

Chemistry: with xanthones (HPTLC by U. Grube; TLC by H. Sipman); isoarthothelin [major], 2,5,7-trichloro-3-O-methylnorlichexanthone [submajor], thiophanic acid [minor], unknown [minor], chodatin [trace], 3-O-methylthiophanic acid [trace], asemone [trace], 5,7-dichloronorlichexanthone [trace], 2,5-dichloronorlichexanthone [minor] (HPLC by J.A. Elix); spot tests K+

Tab. 1. Vegetation relevées. *Localities*: 1-2: c. 16 km NE of Wlotzkas Baken, 120 m, 29. IX. 07; 3-4: Lagune Mountain, c. 70 m, 16. V. 2002; 5-6: Brandberg-West 17. V. 2002; 7-8: Brandberg-West 17. V. 2002; 9: 7 km N of Wlotzkas Baken, 2 km east of the coastal road, c. 25 m; 10: Brandberg W, 2 km N of Cap Cross turnoff, 27,6 km E of coastal road, 25. II. 1987; *Lichen cover and dimension*: 1-3: 40 × 40 cm, lichen cover 60%; 4: 50 × 50 cm, 90%; 5: 60 × 70 cm, 70%; 6: 40 × 50 cm,70%; 7 & 8: 80 × 60 cm, 90%; 9: 1 × 1 m, 10°, 75%, 10: 0.7 × 0.7 m, 20°, 80%. Abundancy scale according to Wirth 1972 (Braun-Blanquet method). Type relevé: # 8.

relevé	1	2	3	4	5	6	7	8	9	10
Characteristic species										
Lecidella crystallina	3	5	4	2b	4	4-5	4	4	3	2b
Caloplaca volkii	2b	+	2a	3	2a	-	2b	1	3	4
Buellia sipmanii	-	2a	2a	2a	2a	1	+	1-2	+	+
Acarospora "gypsi-deserti"	2b	-	-	-	-	2a	-	+	+	r
Associated species										
Teloschistes capensis	-	-	-	1	+	r	1	1	2a	-
Xanthoparmelia walteri	-	-	+	-	+	1	1	2a	-	-
Xanthoria turbinata	-	-	*r*	-	-	-	-	-	-	-
Santessonia sorediata	-	-	1	+	+	-	-	-	-	-
Lecanora substylosa	-	-	r	-	-	-	-	-	-	-
Heterodermia namaqua	-	-	+	-	-	-	-	-	-	-
Lecidea sarcogynoides	-	-	-	-	-	-	-	-	-	*r*

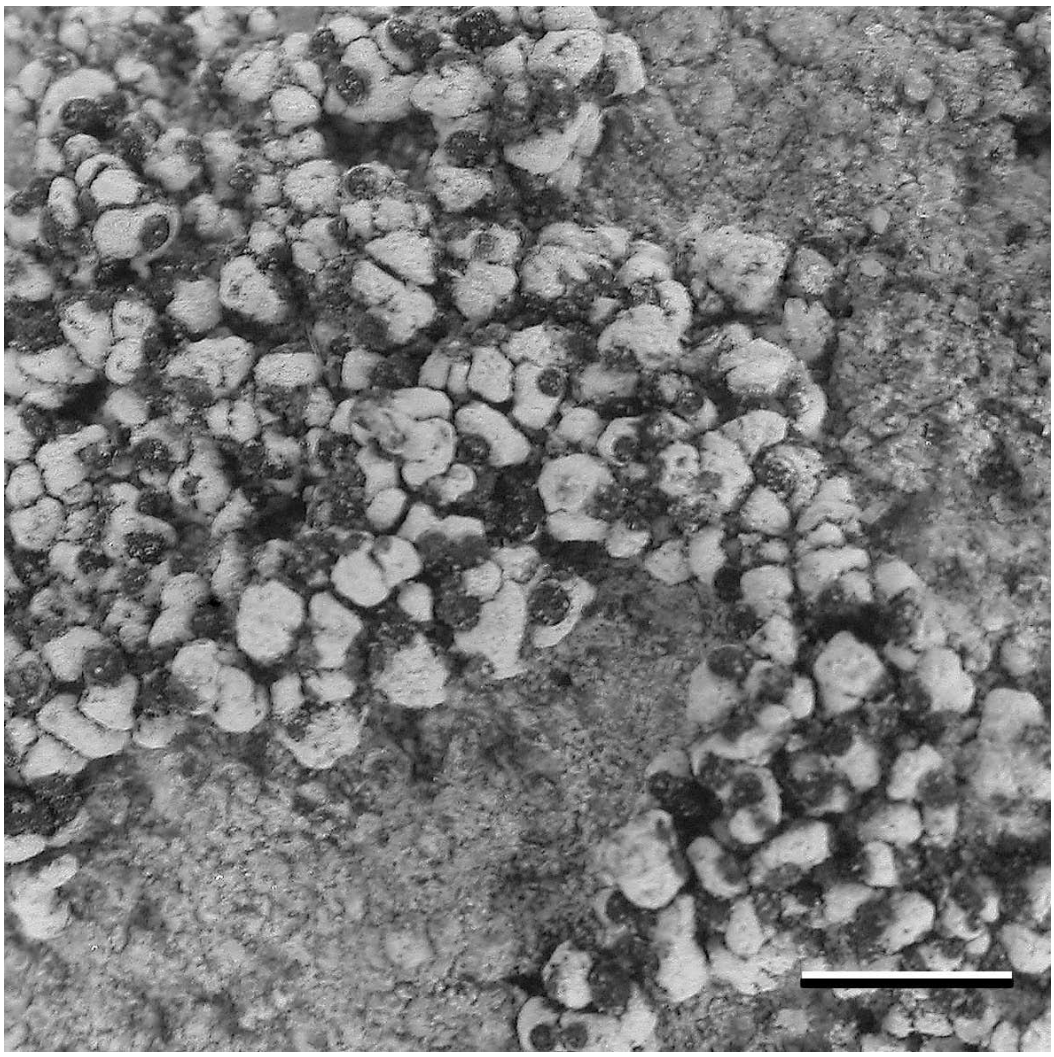

Fig. 1. The bullate to subsquamulose thallus of *Buellia sipmanii* growing on cemented gypsum (scale: 5 mm).

weakly yellow, P–, C+ weakly yellow, KC+ yellow, UV– (dark); thallus not amyloid; all thallus reactions usually weak.

Ecology and distribution: On gypsum, very seldom on rock (HCl–) in desert regions of Namibia. The species is widespread in the central Namib Desert, but restricted to a c. 30 km wide band along the coast within reach of the coastal fog.

Further specimens examined: Namibia. District Omaruru, central Namib Desert: Myl 72, Lagune Mountain, W of peak, 21°49'40.2'' S, 14°04'51.1'' E, 100 m; 11. V. 2002, Wirth-43121 & M. Heklau [KR]; Myl 72, Lagune Mountain, W of peak, 21°49'46'' S, 14°04'45'' E, 75-80 m; 15. V. 2002, Wirth-43116 & M. Heklau [KR]; Wirth-43117 & M. Heklau [KR]; Wirth-43118 & M. Heklau [KR], Wirth-43085 & M. Heklau [KR]; IX. 2007 V. Wirth-40476 & R. Wirth, J. A. Elix [KR]; between Swakopmund and Hentiesbai, lichen plain directly E of coastal road., 22°21'00 S, 14°26'10'' E, c. 30 m; 18. X. 2001, V. Wirth-43120 [KR]; 7 km N of Wlotzkas Baken, 19. IX..-8. XII.1991, V. Wirth-22918 & M. Heklau [STU].

Buellia sipmanii is morphologically very similar to *B. dispersa* and *B. nashii* (BUNGARTZ et al. 2008), having a subsquamulose to bullate thallus of more or less dispersed areoles. It is distinguished, however, by its broadly ellipsoid to almost globose spores with a distinctly thickened wall, and the presence of xanthones. *B. sipmanii* has a strong bluish-green (aeruginose) exciple and epihymenium; in contrast, this pigment is restricted to the outermost exciple of *B. nashii* and does not occur in *B. dispersa*.

Acknowledgements

This contribution and the new species described herein is dedicated to Harrie Sipman, an outstanding lichenologist, of the same generation as the first author, famous for his work on tropical and subtropical lichens. We are indebted to him and to U. Grube (Graz) for first detecting xanthones in the thalli of *Buellia sipmanii* and to J. Elix (Canberra) who resolved their chemical identity. This is publication no. 1078 of the Charles Darwin Research Station.

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