

## Notes on the Gomphillaceae (Lichens) from Guadeloupe (West Indies), with four new species of *Gyalideopsis*

by

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With 11 figures

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**Summary:** An annotated list of 28 lichen species belonging to the Gomphillaceae and found on Basse-Terre in the Guadeloupe archipelago (West Indies) is presented; it includes four species described as new for science: *Gyalideopsis capitata* Sérus., *G. cyanophila* Sérus., *G. giganteoides* Sérus. and *G. vivanti* Sérus.

**Résumé:** Une liste annotée de 28 espèces de lichens appartenant à la famille des Gomphillaceae et trouvées sur Basse-Terre dans l'archipel de la Guadeloupe (Petites Antilles) est présentée; elle comprend quatre espèces nouvelles pour la science: *Gyalideopsis capitata* Sérus., *G. cyanophila* Sérus., *G. giganteoides* Sérus. and *G. vivanti* Sérus.

**Keys words:** Gomphillaceae, Guadeloupe archipelago (West Indies), *Gyalideopsis*.

### Introduction

The lichen family Gomphillaceae is one of the most fascinating in the Tropics, being represented by an always increasing number of species, mainly found in very humid areas. During two short visits (04/1995 and 03/1996) to the island of Basse-Terre in the Guadeloupe archipelago (West Indies), several interesting species were collected and this paper deals with the preliminary results of their studies: 28 species are reported, including 4 new to science. No less than 10 further taxa were discovered; the specimens so far collected are however either sterile (producing only hypophores) or too scanty to allow a proper identification and their study is postponed until better material is available.

In this paper, no attempt has been made to reorganize the generic boundaries in the family and the generic concept of Vězda & Poelt (1987) is adopted, although it is clear that it is highly artificial (see Lücking 1997: 96-102 for an interesting discussion on this matter). A better understanding of the nature of hypophores, which are

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structures restricted to the Gomphillaceae amongst the lichenized fungi, and so far considered to be highly transformed synnemata or conidiophores, and of the way they produce their asexual diaspores, is needed before the relationships between species can be formalized into a new generic division. Investigations on the obviously related taxa, some of them described as non-lichenized fungi, are also required: see Seifert (1985: 128-129 & 131) on *Epilithia cristata* Nyl. and *Microspatha glauca* P. Karsten.

Sérusiaux & De Slover (1986) have proposed a subdivision of hyphophores into morphological groups, based on the symmetry and shape of their stalks and appendages. Hyphophores are long-lived structures and the «conidial mass» they produce is easily dispersed by any mechanical agency, either small animals or water flow and rain droplets. The best hypothesis I can formulate about their phylogenetic or functional relationships is that they derive from or represent analogous structures to the cilia-like conidiophores found in several species of hyphomycetes growing on bark or on leaves immersed in water in tropical areas. Indeed, the conidiophores of the genera *Cryptophiale* Piroz., *Cryptophialoidea* Kuthub & Nawawi and related taxa can be considered as hyphophores (see for example Kuthubutheen 1987, Kuthubutheen & Nawawi 1987a, b & 1994 and Goh & Hyde 1996); for example, the picture and drawings of Goh & Hyde (1996: 1001-1003) show structures that are remarkably similar to hyphophores. In these taxa, conidia are produced by phialidic conidiogenous cells, which is never the case in the Gomphillaceae. But should they grow on a lichenized thallus, the conidiophores of *Speiropsis scopiformis* Kuthub. & Nawawi (1987b) and *Wiesneriomyces conjunctosporus* Kuthub. & Nawawi (1988) would be regarded as genuine hyphophores by most lichenologists. In these taxa, conidia are blastic, sometimes branched, and without septa but with regularly-spaced constrictions (isthmi), are produced in acropetal succession and the conidiogenous cells proliferate sympodially; this development pattern is consistent with the observations made in several representatives of the Gomphillaceae (see fig. 10b & 11a). Of course, the conidiogenesis in this family of lichens has never been studied in detail and may follow several patterns within the family - which would provide strong ground for a new generic delimitation - but the similarities with those hyphomycetes are striking.

It is interesting that all those species grow on organic material - just like most representatives of the lichenized Gomphillaceae - immersed in water. Now, and although a feature still poorly known, several Gomphillaceae which typically grow on living leaves can also be found on rocks near water streams or on very wet decaying bark or other organic material (see below under *Echinoplaca verrucifera*, *Gyalectidium filicinum* and *Tricharia albostrigosa*). It can be postulated that genuine hyphophores represent an adaptation to more xeric habitats, or at least to habitats that are prone to dramatic changes in moisture conditions, like living leaves or tiny branches and twigs. In such conditions, the conidia produced would not dispersed alone but would coalesce in the «conidial mass» that is so typical of the Gomphillaceae, and be dispersed as a single diaspore. Tretiach et al. (1996: 238) have observed that, in *Gyalideopsis mexicana*, all hyphophores collected after heavy rain have a «well-developed, translucent, turgid conidial mass» while, in specimens collected when

dry, only a few still have a conidial mass at the tip of their stalk. These interesting observations could mean that the conidial mass is produced during wet periods and dispersed during desiccation.

## Methods

The material was observed in tap water, in Lugol's iodine solution, in lactophenol cotton-blue (LCB) or in ammoniacal erythrosin. The measurements given in this paper always refer to preparations in water. The material is preserved in LG herbarium and representative collections will be deposited in the Herbarium of the National Park of Guadeloupe (GUAD).

## New species of *Gyalideopsis* Vězda

*Gyalideopsis capitata* Sérusiaux sp. nov.

Fig. 1-3

*Gyalideopsis* cum hyphophoris conidiorum massulam globosam terminatis species insignis, ascis 1-sporibus, apotheciis urceolatis et conidiis 10-12-septatis, 52-54 × 3 μm longis.

Thallus corticolous or overgrowing epiphytic bryophytes (mainly liverworts), forming irregular and +/- continuous patches (the largest measuring c. 1.5 cm in diam.), greyish green to greyish white, usually varnish-like, containing large and colourless crystals (best seen under polarized light), without prothallus. Photobiont: most probably a species of the Chlorococcaceae, with green, spherical cells, 8-12 μm in diam.

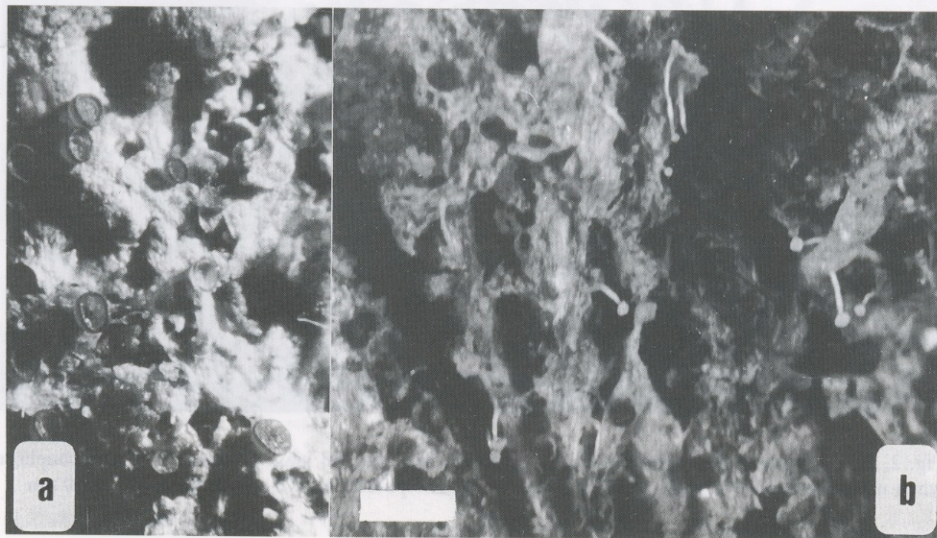


Fig. 1. *Gyalideopsis capitata* (Sérusiaux 17051) - a: apothecia; b: capitate hyphophores. Scale = 0.5 mm.

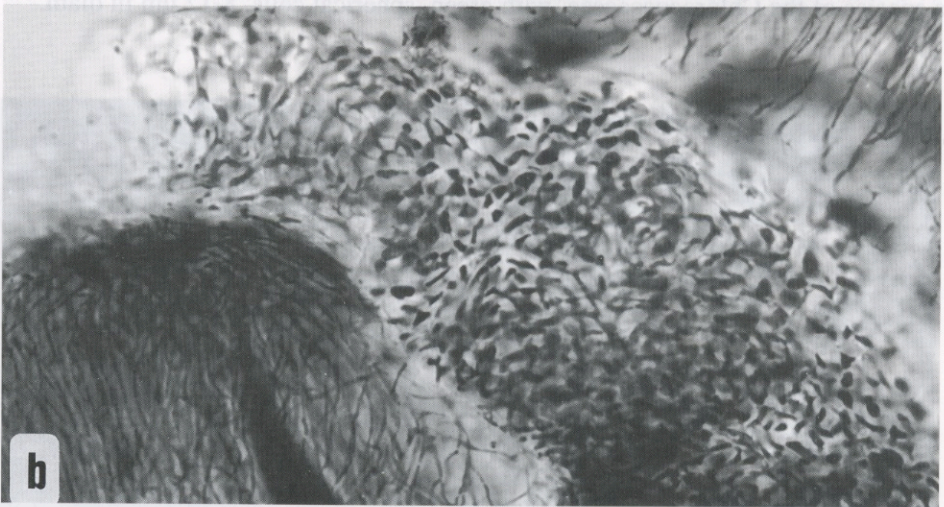
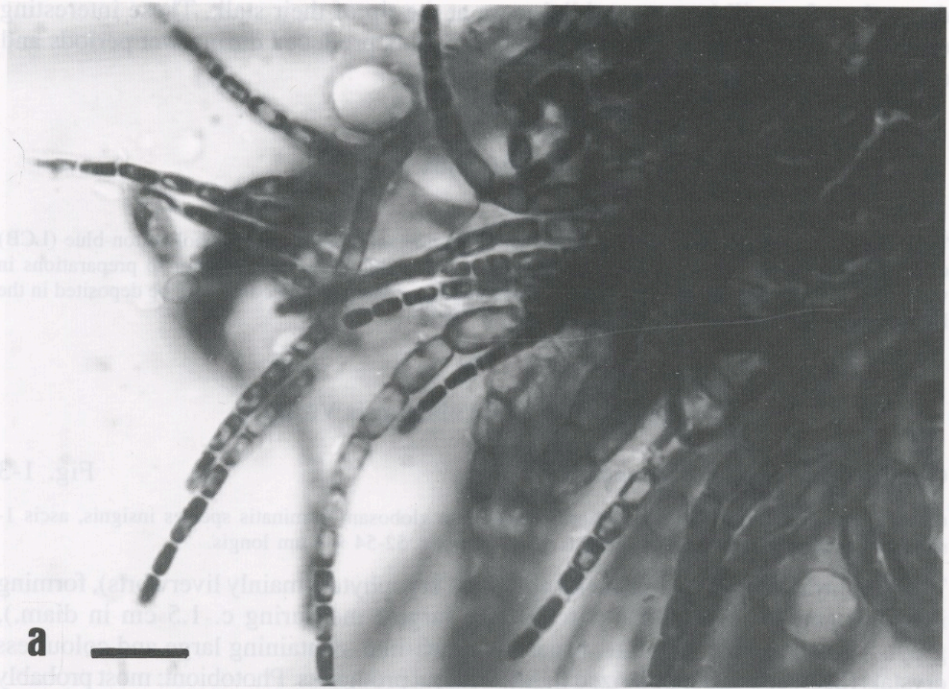


Fig. 2. *Gyalideopsis capitata* (holotype) - a: surface of the conidial mass produced by the hyphophore when moistened and eventually mounted in LCB; b: exciputum in LCB. Scale for a & b = 10  $\mu$ m.

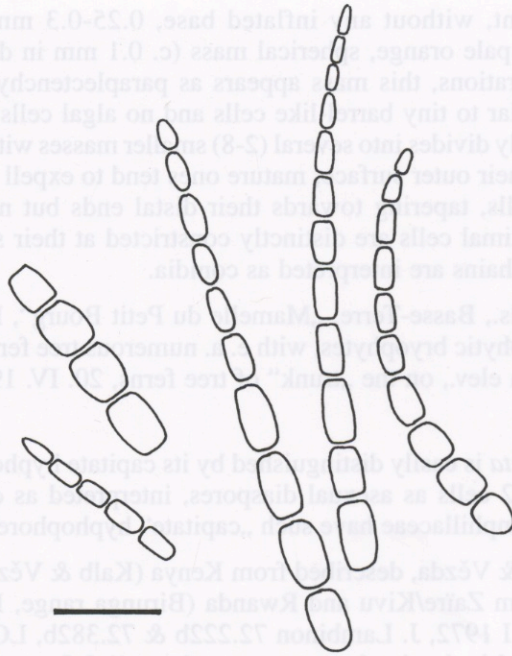


Fig. 3. *Gyalideopsis capitata* (holotype) - conidia expelled by the capitulate conidial mass of the hyphophore when mounted in water. Scale = 10  $\mu$ m.

Apothecia absent on a few thalli, abundant when they are present, circular, 0.15-0.2 (-0.3) mm in diam. and c. 0.2 mm high, strongly constricted at their base, urceolate; disc concave, becoming almost flat in the largest apothecia, pale orange to brownish, sometimes almost black (usually in young apothecia), always paler than the margin, with a minutely rugose or papillose surface when old; margin always distinct, prominent and darker than the disc (orange brown to dark brown, sometimes with a reddish hue).

Excipulum made of densely branched and anastomosing hyphae, radiately arranged and forming a typical prosoplectenchymatous tissue on the outer edges, brownish in its outer parts and at margin levels, otherwise hyaline or pale orange, usually c. 50  $\mu$ m under the hypothecium but up to 80-100  $\mu$ m in the oldest apothecia, 25-45  $\mu$ m laterally; hymenium hyaline, 110-120  $\mu$ m high; hypothecium hyaline, less than 20  $\mu$ m high; hamathecium of branched and anastomosing paraphyses, 1  $\mu$ m thick; asci clavate, thin-walled; spores 1/ascus, hyaline, muriform, ellipsoid, 64-110  $\times$  36-42  $\mu$ m, protruding out of the apothecium surface when old, and then with their upper surface dark brown and each cell producing numerous, ellipsoid (sometimes almost bacilliform) conidia, c. 2  $\times$  0.75  $\mu$ m.

Hyphophores cilia-like (the numerous cilia present on several thalli are interpreted as immature hyphophores or hyphophores which have discharged their conidial mass),

white or translucent, without any inflated base, 0.25-0.3 mm long, carrying a translucent to very pale orange, spherical mass (c. 0.1 mm in diam.) of conidia at their tips. In preparations, this mass appears as paraplectenchymatous, with very numerous rectangular to tiny barrel-like cells and no algal cells. When moistened, the mass immediately divides into several (2-8) smaller masses with long and tapering chains of cells on their outer surface; mature ones tend to expell  $52-54 \times 3 \mu\text{m}$  long chains of 10-12 cells, tapering towards their distal ends but nevertheless with a rounded apex; proximal cells are distinctly constricted at their septa and look like tiny barrels; these chains are interpreted as conidia.

Type: Guadeloupe Is., Basse-Terre, „Mamelle du Petit Bourg“, low forest near the summit, rich in epiphytic bryophytes, with e. a. numerous tree ferns and *Podocarpus coriaceus*, c. 700 m elev., on the „trunk“ of tree ferns, 20. IV. 1995, Sérusiaux s.n. (LG-holotype).

*Gyalideopsis capitata* is easily distinguished by its capitate hyphophores, producing long chains of c. 12 cells as asexual diaspores, interpreted as conidia. Few other members of the Gomphillaceae have such „capitate“ hyphophores:

- *G. africana* Kalb & Vězda, described from Kenya (Kalb & Vězda 1994: 514-515) but also known from Zaïre/Kivu and Rwanda (Birunga range, Karisimbi, 3550 & 3850 m, 21 I & 28 I 1972, J. Lambinon 72.222b & 72.382b, LG), has 2 muriform spores per ascus and its hyphophores are very long (1-2.5 mm high) and produce filiform, multi-septate conidia  $100-120 \times 1.5 \mu\text{m}$  long;

- *Tricharia cretacea* Vězda, known from USA/New Mexico (Vězda 1979: 72-73), has a pilose thallus, large (0.6-0.8 mm in diam.) apothecia (mature ascospores are unknown) and its hyphophores are 0.8-1 mm long and produce branched conidia. The generic position of this species is unclear;

- *G. kalbii* Vězda, known from Brazil (Vězda 1983: 153-154), has pink substipitate apothecia, 4-8 muriform spores per ascus and its hyphophores produce 1(-3)-septate,  $8-10 \times 2 \mu\text{m}$  conidia;

- *G. mexicana* Tretiach & al., known from the Chihuahua prov. in Mexico (Tretiach & al. 1996), has large apothecia (1.5-2.0 mm in diam.), 2-8 submuriform to muriform ascospores and its hyphophores produce conidia which are septate only near their base and that measure c.  $150 \times 1.5 \mu\text{m}$ ;

- *G. stipitata* Kalb & Vězda, known from Ecuador (Kalb & Vězda 1994: 521-523), has large and stipitate apothecia and its hyphophores are 1-1.5 mm long and produce tapering, multi-septate conidia  $100-130 \times 2-2.2 \mu\text{m}$ .

Kalb & Vězda (1988: 28) have also shortly described *Echinoplaca subsimilis*, from Guatemala, with capitate hyphophores but left it unpublished for the available material was too scanty. From the illustration provided for the conidial mass of its hyphophores (fig. 12), there is no doubt it is not *Gyalideopsis capitata*.

The hyphophores of several other species of *Gyalideopsis* also disperse long and tapering chains of conidia, e.g. *G. krogiae* Kalb & Vězda (see Kalb &

Vězda 1994: 517-518; fig. 4) but the sterile parts of the hyphophores are markedly different.

In *G. capitata* as well as in other members of the genus, the conidial mass is disrupted when mounted for microscopical examination, and many fragments of the conidia are observed. I have described them as 10-12-septate and measuring  $52-54 \times 3 \mu\text{m}$  after a selection of the „best preserved“ ones; fragments of those chains of cells may of course also be dispersed in situ, when small animals or water droplets hit the hyphophores and its capitata conidial mass.

The disc of most mature apothecia have several tiny verrucae (thus, the surface can be described as rugose or papillose) that correspond to protruding ascospores. These do not disperse as such, as their upper part forms a paraplectenchymatous and brownish cortex whilst the remainder disintegrates into tiny conidia. This is not a rare phenomenon in tropical lichens producing large and muriform ascospores; it is described in at least one species of *Gyalideopsis*, e.g. *G. graminicola* Vězda & Kantvilas, known from Tasmania (Kantvilas & Vězda 1992: 667).

*Gyalideopsis capitata* is known from several localities on Basse-Terre, always growing on bark, between 260 and c. 700 m elev.

Other specimens examined (all in LG): Same locality as the type, 21.III.1996, Sérusiaux 17153 & 17166; Basse-Terre, river «St-Jean», humid forest managed as a park, near the picnic area, 260 m elev., 19. & 21.III.1996, Sérusiaux 17051; Basse-Terre, track between the «Col des Mamelles», and «Morne Léger», c. 600 m elev., 24.III.1996, Sérusiaux 17337.

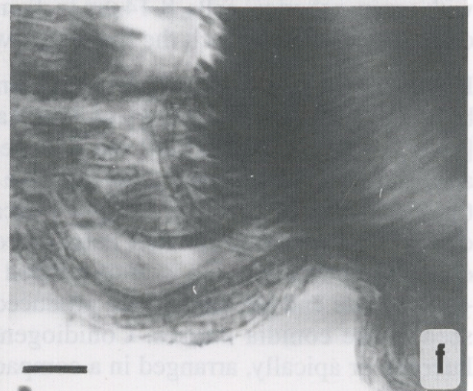
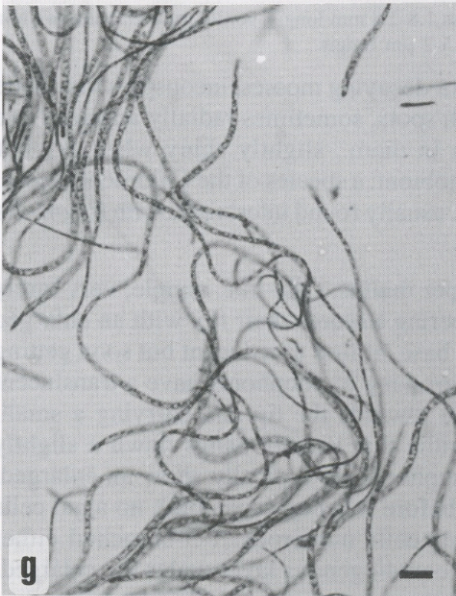
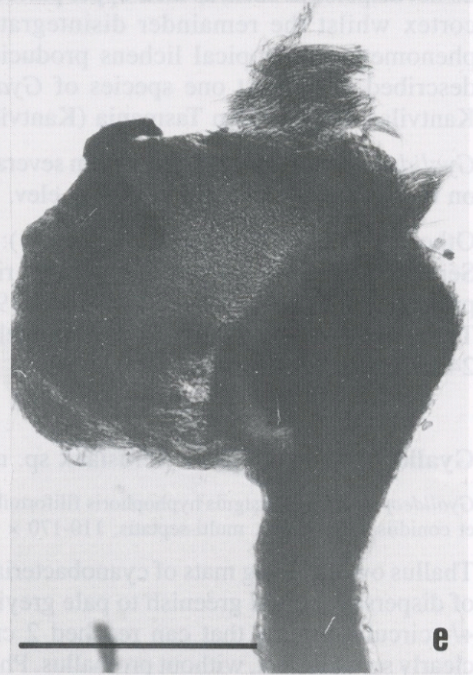
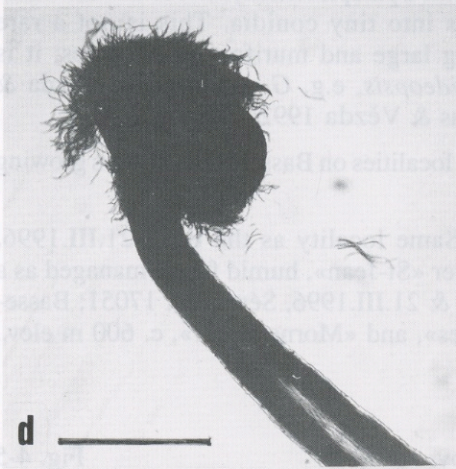
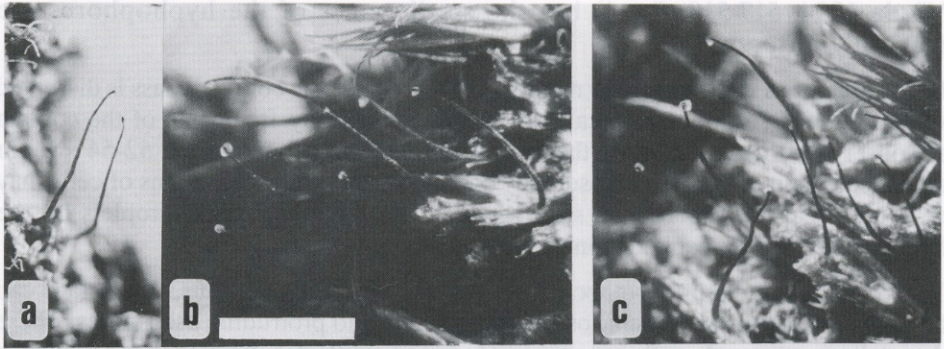
### ***Gyalideopsis cyanophila* Sérusiaux sp. nov.**

Fig. 4-5

*Gyalideopsis* species insignis hyphophoris filiformibus, 1.8-2.8 mm longis, conidiorum massula pendula et conidiis filiformibus, multi-septatis,  $110-170 \times 1.5-2 \mu\text{m}$  longis.

Thallus overgrowing mats of cyanobacteria or decaying mosses, inconspicuous, made of dispersed incised greenish to pale greyish spots, sometimes radially arranged in a +/- circular thallus that can reach 2 cm in diam., slightly shiny when dry but clearly so when wet, without prothallus. Photobiont: a species of the Chlorococcaceae, with green, spherical cells, 8-14  $\mu\text{m}$  in diam., usually found intermixed with fragments of the substrate on which the thallus grows.

Hyphophores sparse, usually less than ten per thallus, cilia-like, simple, very rarely bifurcate near the tip, 1.8-2.8 mm long, tapering towards their tip, with an enlarged [up to 0.12-0.14 (-0.18) mm] and flattened base, at first translucent but soon getting a typical dark brown color from the base (growing hyphophores have a translucent tip and a dark brown base), slightly arcuate towards the tip and carrying a small, ovoid or lacrimiform to pointed mass of conidia that usually hangs down a slightly enlarged tip (mature and well-developed hyphophores typically show an enlarged, +/- spatulate end but conidia are produced before it becomes visible); no algal cells seen in the conidia masses. Conidiogenous cells numerous, 1-3-branched either laterally or apically, arranged in a compact conidiogenous layer under the enlarged,





+/- spatulate tip of the hyphophore; conidia filiform, typically twisted when moistening, distinctly clavate when growing but with an only slightly clavate upper part when mature,  $110-170 \times 1.5-2 \mu\text{m}$ , multi-septate (each cell being  $5-9 \mu\text{m}$  long), with numerous oils droplets in most cells, especially in fresh material.

Apothecia not found.

Type: Guadeloupe Is., Basse-Terre, summit of the volcano «La Soufrière», low and shrubby vegetation over recent and disturbed lava flows, on frequently inundated moss carpets, c. 1450 m elev., 30.III.1996, Sérusiaux 17473 (LG-holotype; B-isotype).

Although no apothecia could be found in the abundant material collected, I do not hesitate to describe this species as new in the genus *Gyalideopsis*. Indeed, its very long hyphophores with an applanate base and carrying a hanging mass of very long, filiform and multi-septate conidia are unique in the whole Gomphillaceae and the genus *Gyalideopsis* is the best choice for it, at least with the current circumscription of genera. Other species producing such conidia are:

- *G. africana* Kalb & Vězda (Kalb & Vězda 1994: 514-515; see above), and *G. stipitata* Kalb & Vězda (Kalb & Vězda 1994: 521-523; see above) which both have capitate hyphophores;

- *G. calabrica* Puntillo & Vězda (Puntillo & Vězda 1991), described from Italy/ Calabria, *G. muscicola* P. James & Vězda (Vězda 1972: 211-214), a Western European species, *G. robusta* Kalb & Vězda (Kalb & Vězda 1988: 45-46), described from Brazil/Sao Paulo and *G. williamsii* Kalb & Vězda (Kalb & Vězda 1994: 523-525), described from Australia/New South Wales have hand-shaped hyphophores with an apical long cilium (a «rostrum»; *G. robusta*) or several distinct cilia.

*Gyalideopsis cyanophila* is known only from the type-locality, near the summit of the still active volcano «La Soufrière», where it can be quite common on mats of cyanobacteria overgrowing mosses (mainly *Campylopus richardii* Brid.; det. S. R. Gradstein), on gentle slopes and in frequently inundated hollows. The summit of the volcano receives almost 10 m of rain per year and its lichen flora must endure frequent storms and inundations; it comprises *Dictyonema glabratum* (Spreng.) D. Hawksw., *Dibaeis absoluta* (Tuck.) Kalb & Gierl, *Phyllobaeis erythrella* (Mont.) Kalb, *Gomphillus ophiosporus* Kalb & Vězda, *Stereocaulon virgatum* Ach., etc. Very few species occupy the same niche as *G. cyanophila*: a common, *Placynthiella*-like species that could not be identified and a most probably new species of *Thelocarpon* [perithecia yellow and non-pruinose, c. 0.3 mm in diam. and 0.3-0.4 mm high; algal sheath absent; paraphyses present, simple and sometimes anastomosed; ascus walls I+ blue, with a I+ dark blue tholus; ascospores > 50/ascus, ellipsoid, without any pseudoseptum,  $15-19(-21) \times 5-6 \mu\text{m}$ ] have been collected together with it.

Fig. 4. *Gyalideopsis cyanophila* (holotype) - a-c: hyphophores (a: without any conidial mass; b-c: with a conidial mass at the tip of each hyphophore), scale = 2 mm; d: upper part of a hyphophore mounted in LCB with conidia being expelled out of the conidial mass, scale = 160  $\mu\text{m}$ ; e: upper part of the conidial mass, mounted in LCB, scale = 100  $\mu\text{m}$ ; f: detail view of the conidiogenous cells and basal parts of the conidia (mounted in LCB), scale = 10  $\mu\text{m}$ ; g: mature conidia (in LCB), scale = 10  $\mu\text{m}$ .

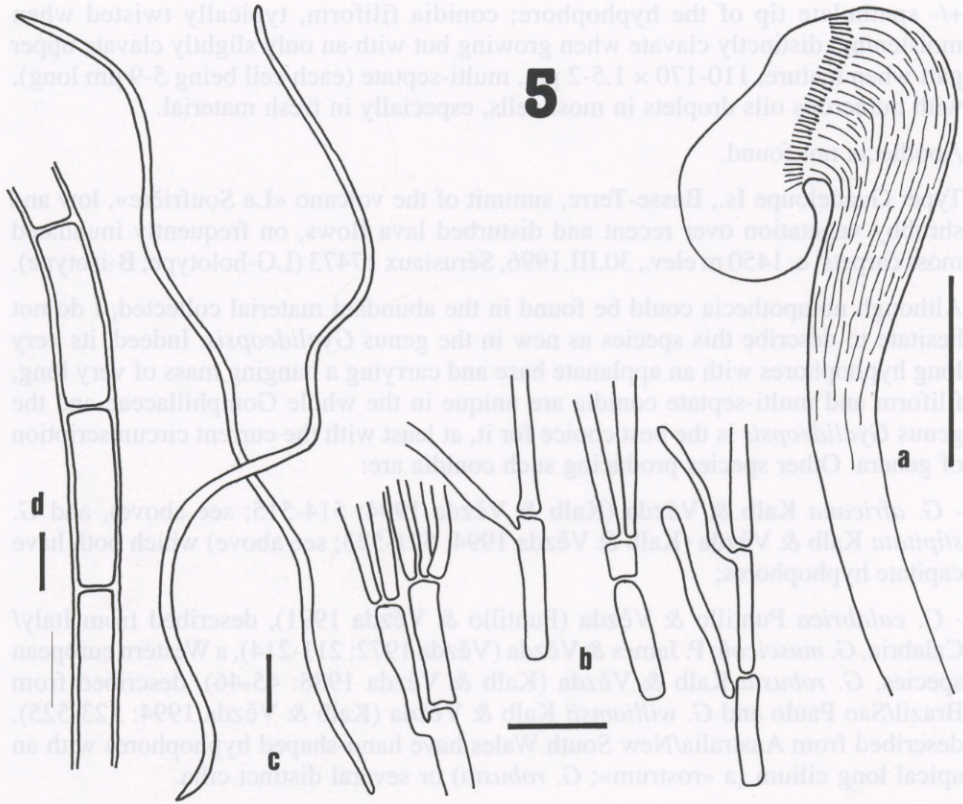


Fig. 5. *Gyalideopsis cyanophila* (holotype) - a: mature hyphophore with its conidial mass hanging down its tip, scale = 100  $\mu$ m; b: pattern of conidiogenesis, scale = 10  $\mu$ m; c: shape of conidia (transverse septa not represented), scale = 10  $\mu$ m; d: detail view of the conidia septation, scale = 2  $\mu$ m.

***Gyalideopsis giganteoides* Sérusiaux sp. nov.**

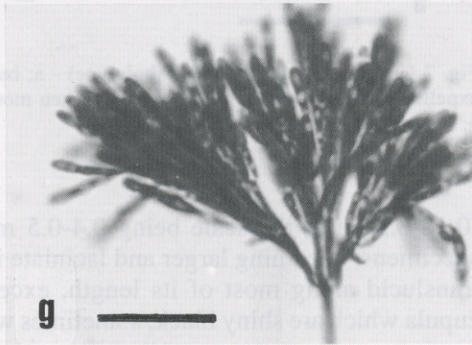
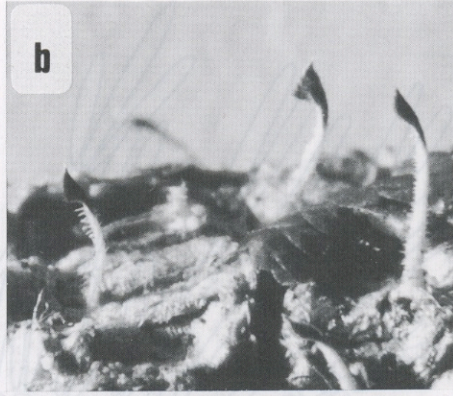
Fig. 6-7

Species distincta a *Gyalideopsis gigantea* hyphophoris hirsutis et brevioribus (1.7-2.2 mm longis).

Thallus corticolous, forming rather regular patches (measuring up to 1 cm in diam.), green to cinereous grey, shiny and varnish-like, without prothallus. Photobiont: most probably a species of Chlorococcaceae, with green, spherical cells, 8-12  $\mu$ m in diam.

Hyphophores abundant, regularly distributed over the thallus surface, formed of a long stipe carrying a +/- triangular or cuneiform cupula (which can also be described a cucullate scale) with its concave face looking downwards, with a total length of 1.7-2.2 mm; the stipe being 0.12-0.15 mm thick and somewhat larger near its base

Fig. 6 *Gyalideopsis giganteoides* (holotype) - a-c: mature hyphophores, scale = 2 mm; d: view of the hairs on the hyphophore stipe (mounted in water), scale= 30  $\mu$ m; e: mature conidia (in LCB), scale = 20  $\mu$ m; f-g: bundles of conidiogenous cells and immature conidia expelled from a fragment of hyphophore when mounted in LCB and slightly pressed, scale = 20  $\mu$ m.



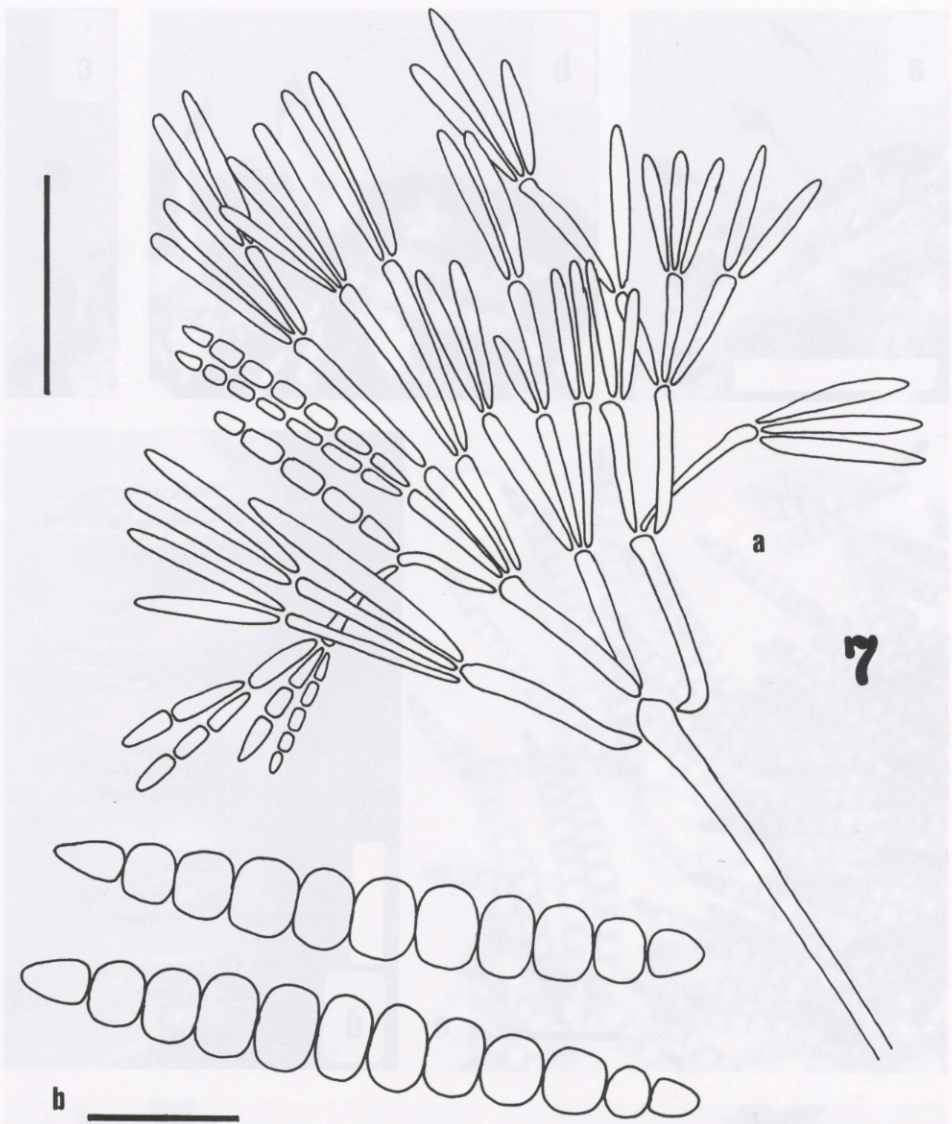


Fig. 7 *Gyalideopsis giganteoides* (holotype) - a: bundle of conidiogenous cells and immature conidia expelled from a fragment of hyphophore when mounted in LCB and slightly pressed, scale = 30  $\mu$ m; b: mature conidia, scale = 10  $\mu$ m.

(0.18-0.2 mm); the scale being 0.4-0.5 mm long and c. 0.35 mm large in mature specimens, becoming larger and laciniate in old and overmature ones; white and not translucent along most of its length, except for its upper parts and the triangular cupula which are shiny black, sometimes with a hue of blue, margins of the triangular

cupula membranous and translucent; stipe pilose, covered with perpendicularly growing white hairs, c. 60  $\mu\text{m}$  long and 15-20  $\mu\text{m}$  thick, regularly distributed along its length. In mature hyphophores, the cupula contains a gelatinous mass that divides into very numerous bundles of 40-80 conidia when mounted in water and containing no algal cells. Conidigenous cells numerous, 1-3(-4) apically branched; conidia fusiform with both ends tapering, with 10-12(-14) transverse septa, distinctly constricted at the septa when mature, and thus with each cell becoming almost spherical, (38-)41-50  $\times$  4-5  $\mu\text{m}$ .

Apothecia not found.

Type: Guadeloupe Is., Basse-Terre, «Mamelle du Petit Bourg» low forest near the summit, rich in epiphytic bryophytes, with e. a. numerous tree ferns and *Podocarpus coriaceus*, on twigs, c. 700 m elev., 21.III.1996, Sérusiaux 17171 (LG-holotype; B-isotype).

This new species is very close to *Gyalideopsis gigantea* Kalb & Vězda (1994: 515-517), described from Ecuador; thus, although it is known from two collections devoid of apothecia, there is little doubt that it belongs to the genus *Gyalideopsis* as circumscribed by Vězda & Poelt (1987). It differs from *G. gigantea* by its shorter hyphophores (1.7-2.2 vs 3-3.5 mm long in *G. gigantea*) and by the exuberantly hirsute surface of their stipes (tomentose, without any distinct hairs in *G. gigantea*). The color of the stipe seems to provide a further criterion as it is pale brown in *G. gigantea* and almost pure white in *G. giganteoides*.

*G. giganteoides* is known from two localities on Basse-Terre: one is on lignum in a humid forest locality at 260 m elev. and the other one (type) is on tiny twigs of a shrub on a hill summit at c. 700 m elev. The position of the species in the latter locality was extraordinary as it was found only at the extremities of +/- vertical twigs, underneath the «protection» of terminal leaves; almost all thalli with their hyphophores looking downwards were confined to such a peculiar niche, well protected from the impact of rain droplets.

Other specimen: Guadeloupe, Basse-Terre, river «St-Jean» humid forest managed as a park, near the picnic area, 260 m elev., 19. & 21.III.1996, Sérusiaux 17057 (LG).

### ***Gyalideopsis vivantii* Sérusiaux sp. nov.**

Fig. 8-11

Species distincta a *Gyalideopsis aterrima* apotheciis 0.25-0.4 mm in diam., cum margine leviter incisa et sporis 1(-2)-septatis.

Thallus saxicolous or overgrowing saxicolous mats of cyanobacteria, forming irregular and +/- continuous patches that can reach c. 10 cm in diam. but usually much smaller, pale cinereous grey, sometimes with small white dots corresponding to crystals accumulation within the thallus, usually shiny and varnish-like, without prothallus. Photobiont: most probably a species of Chlorococcaceae, with green, spherical cells, 8-14  $\mu\text{m}$  in diam.

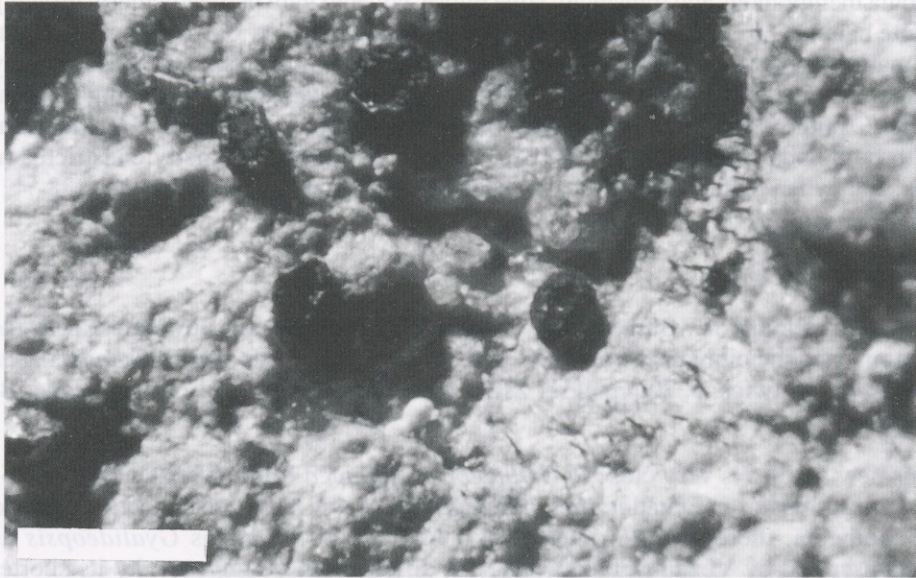


Fig. 8. *Gyalideopsis vivanti* (holotype) - thallus with apothecia and hyphophores, scale = 1 mm.

Apothecia present on all thalli examined, circular or irregular (sometimes almost folded like a sandwich), 0.25-0.4 mm in diam. and 0.12-0.15 mm in height, strongly constricted at their base; disc plane, black or dark red, rather shiny, rarely lividous; margin black, always strongly prominent, regular or undulate or radiately cracked.

Excipulum made of densely branched and agglutinated hyphae, dark brown and visible only in the inner part, carbonaceous at the outer edges, 20-45  $\mu\text{m}$  thick laterally, present under the hypothecium, except in the very centre of the apothecium; hymenium hyaline, 70-80  $\mu\text{m}$  thick; hypothecium hyaline, less than 30  $\mu\text{m}$  thick; hamathecium of very numerous and densely packed, branched and anastomosed paraphyses, 1  $\mu\text{m}$  thick; epithecium distinct, made of the upper parts of the paraphyses that become brown to dark brown, without crystals; asci clavate, 40-50  $\times$  15-20  $\mu\text{m}$ , usually with a distinct stipe, thin-walled, with a typical and very distinct concave depression of the ascoplasma in the upper parts, with their cytoplasma K/I + reddish; spores 8/ascus, hyaline, 1(-2)-septate, ellipsoid to bacilliform, with rounded ends, usually with one tapering cell, slightly but distinctly constricted at the septum, with a distinct halo (c. 1  $\mu\text{m}$  thick) all around, dissolving in a KOH solution, 13-15  $\times$  4.5-5  $\mu\text{m}$ .

Hyphophores abundant but sometimes scarce on parts of the thallus, cilia-like, black, straight, with a blunt apex (never tapering), 0.1 -0.16(-0.2) mm long and 30-45  $\mu\text{m}$  thick, slightly enlarged at their base, carrying a translucent, drop-like mass of conidia on one side that is connected to the cilium apex by several (less than 20), septate,

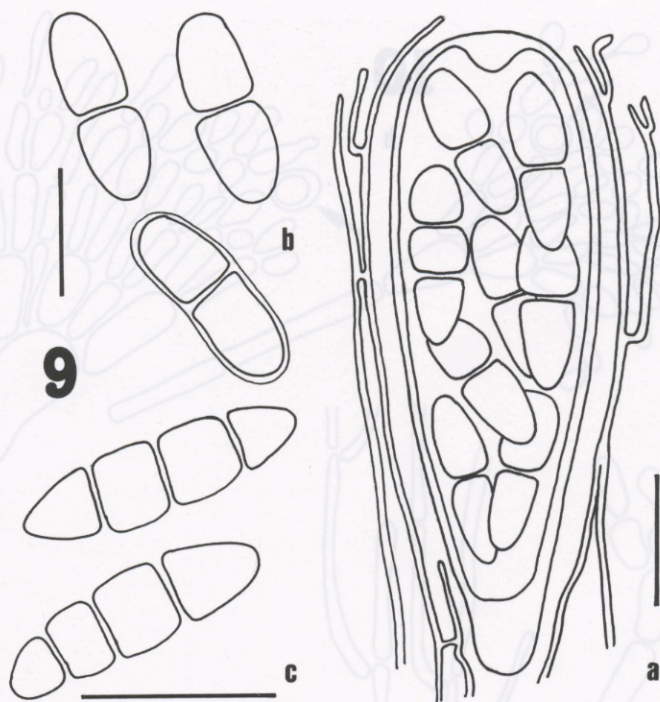


Fig. 9. *Gyalideopsis vivanti* (holotype) - a: hamathecium and one ascus with spores, scale = 10  $\mu$ m; b: mature ascospores (one featured with its halo), scale = 10  $\mu$ m. *G. aterrima* (holotype) - c: mature ascospores, scale = 10  $\mu$ m.

thick-walled hyphae (c. 3  $\mu$ m in diam.); in squash preparations mounted in water, mass of conidia dividing into several (3-9 per hyphophore) smaller masses, 30-50  $\mu$ m in diam., each connected to the hyphophore apex by a single thick-walled hypha and each always containing several algal cells; branched chains of irregularly swollen cells, c. 3-7  $\times$  2-3  $\mu$ m interpreted as conidia. The conidial mass also includes long and laterally branched hyphae, 1-1.5  $\mu$ m thick; they are interpreted as hyphae formally carrying conidiogenous cells and a conidial mass which has been discharged. Pycnidia sometimes present at the margins of confluent thalli, appearing like black dots on the thallus surface, c. 50  $\mu$ m in diam.; conidia ellipsoid to almost bacilliform, 2-3  $\times$  < 1  $\mu$ m.

Type: Guadeloupe Is., Basse-Terre, Summit of the vulcano „La Soufrière“, c. 1450 m elev., small lava blocks and pebbles with oozing water, within moor vegetation, 27.IV.1995, Sérusiaux s.n. (LG-holotype; B-isotype).

This species was first referred to an immature form of *Gyalideopsis aterrima* Vězda Poelt, described from a single collection gathered at 3500 m in Venezuela (Vězda & Poelt 1973: 473-476). Examination of the type material [Merida, Paramo de Mucuchies, III.1969, B. & F. Oberwinkler and Poelt s. n. (GZU-holotype!)]

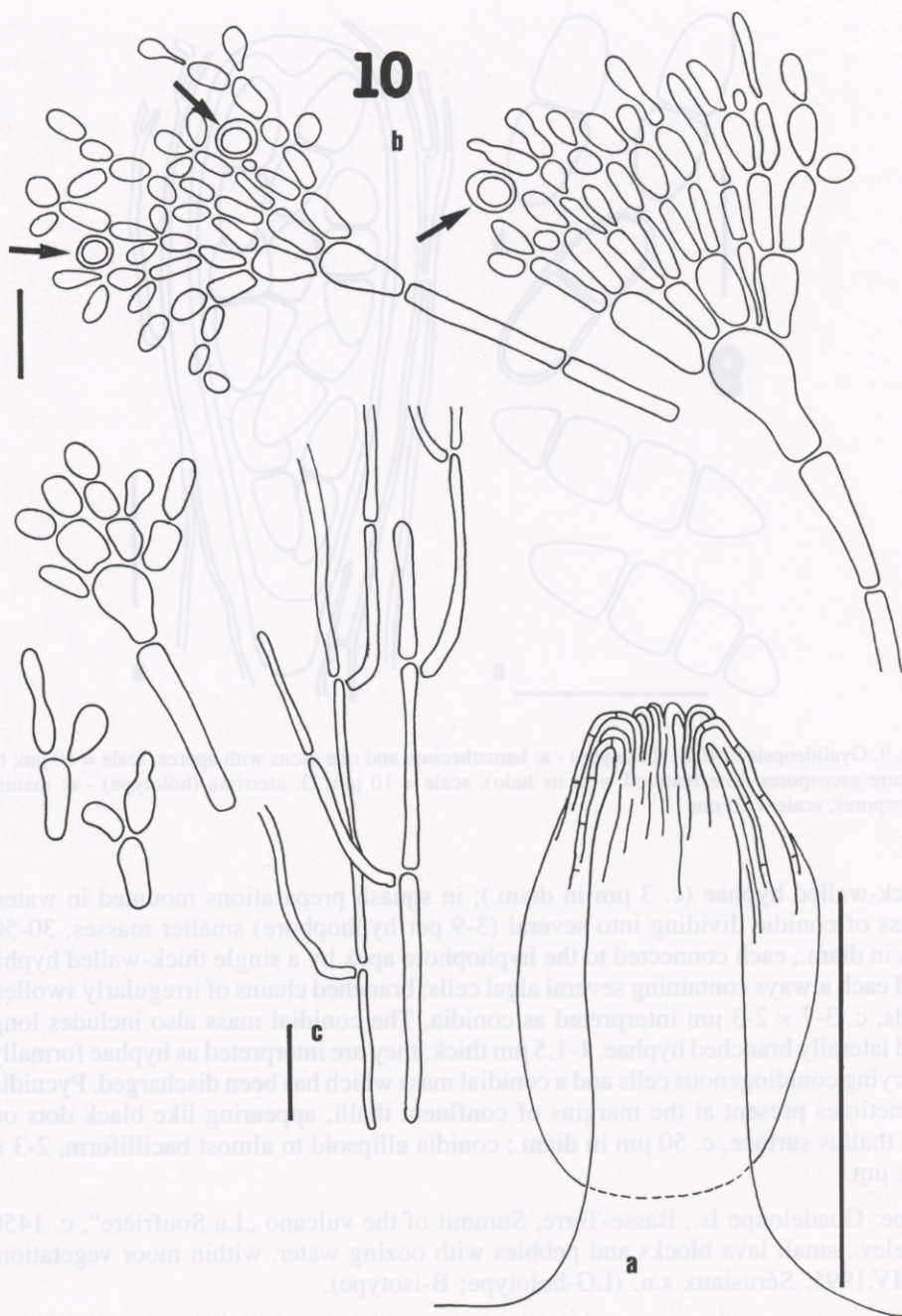


Fig. 10. *Gyalideopsis vivanti* (holotype) - a: hyphophore carrying its conidial mass, scale = 0.1 mm; b: bundles of conidiogenous cells and conidia, with algal cells (arrows), scale = 10  $\mu$ m; c: branching pattern of hyphae carrying conidiogenous cells in the conidial mass, scale = 10  $\mu$ m.



demonstrates it is a closely related but different species. *G. aterrima* has got rather small apothecia (rarely exceeding 0.3 mm in diam.), sessile on the thallus or slightly constricted at the base, with a thick margin which is strongly radiately cracked and thus has distinct radiate ridges (*G. vivantii* has got larger apothecia which are strongly constricted at their base and their margin is much less radiately cracked); moreover its spores are ellipsoid with rather acute ends and always 3-septate [in *G. vivantii*, the spores are ellipsoid to bacilliform with rounded ends and 1(-2)-septate]. These differences provide a sound basis for the recognition of two species.

*G. vivantii* is also closely related to the recently described *G. zeylandica* Vězda & Malcolm (1997), known from a single collection made at 120 m elev. on South Island in New Zealand. The latter is easily distinguished by its regular, adnate and rather large (0.5-0.75 mm in diam.) apothecia with a thick and black margin which is not radiately cracked. Its spores are also 3-septate and about the same size as in *G. vivantii* but may have a longitudinal septum.

*G. aterrima*, *G. vivantii* and *G. zeylandica* are also close to *G. lecideina* Kalb & Vězda (Kalb & Vězda 1988: 41-42) and to *G. poeltii* Vězda (Vězda 1983: 155-156), both described from Brazil. All these species have a black carbonized apothecial margin, grow directly on rocks and, when known (in *G. poeltii*, *G. vivantii* and *G. zeylandica*), have hyphophores of the *Aulaxina*-type. They may represent a monophyletic group that requires generic level.

It should also be noticed that, in *G. vivantii*, the conidial mass produced by the hyphophores have always been seen with algal cells into it: both partners of the symbiosis can thus be dispersed together.

*G. vivantii* is named after our colleague and friend J. Vivant (Orthez, France) who, in collaboration with A. Vězda, has published a catalogue of the foliicolous lichens found in Guadeloupe (Vězda & Vivant 1992) and who is also an expert on the numerous fern species found in the archipelago.

*Gyalideopsis vivantii* has been found only on the volcano «La Soufrière», between 1150 and the summit at 1450 m; it can be abundant on lava blocks, including on tracks, and prefers small pebbles. It is a pioneer species that cannot compete against other plants (including mosses) that colonize the lava. The saxicolous lichen flora of the volcano has not yet been thoroughly studied but includes the very abundant *Stereocaulon virgatum* Ach., several lecideoid species and one species of *Acarospora*.

Other specimens: Same locality as the type, 30.III. 1996, Sérusiaux 17479 (LG); «Savane à mulets» near the volcano «La Soufrière», track towards the «Piton Tarade», 1150-2000 m elev., on pebbles on the track, 22.III. 1996, Sérusiaux 17207 with L. Redaud (LG).

#### **Annotated list of the other Gomphillaceae found on Basse-Terre in Guadeloupe archipelago:**

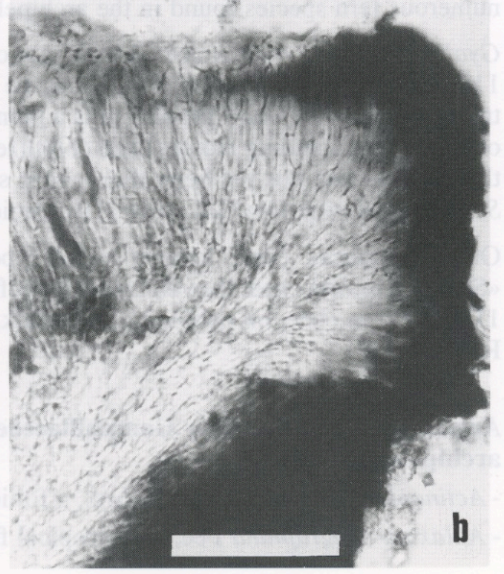
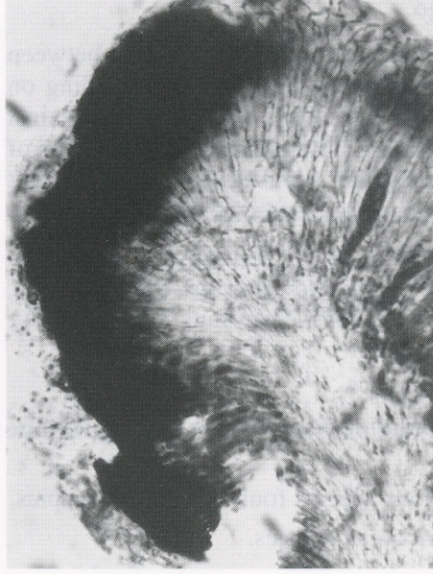
- *Actinoplaca strigulacea* Müll. Arg., a foliicolous species found in the Neotropics.
- *Aulaxina opegraphina* Fée, a pantropical foliicolous species.

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found in Guadaloupe (Vézda & Vivant 1997) and who is also an expert on the



- *A. submuralis* Kalb & Vězda, a foliicolous species, previously known only from S-E Brazil (Kalb & Vězda 1988: 17) and Costa Rica (Lücking 1997: 31-32), has been found on Basse-Terre near the river Moreau. It is here also reported from Central Africa: Zaïre, Kivu, Irangi, IRSAC reserve, c. 850 m elev., on leaves of *Myrianthus arboreus* and *Aframomum* sp., 3 I 1972, J. Lambinon 72/22 & 72/31 (LG).
- *Calenia graphidea* Vain., a pantropical foliicolous species.
- *C. triseptata* Zahlbr. (= *C. submaculans* R. Sant.), a foliicolous species found in the Neotropics.
- *Echinoplaca argentea* (Mont.) Vain., reported as foliicolous at St-Claude by Vězda & Vivant (1992: 278), but not found in my own collections. This taxon is now considered to be a corticolous representative of the genus *Gyalideopsis* [Kalb & Vězda 1988: 53; *G. argentea* (Mont.) Kalb & Vězda] and the foliicolous populations are referred to *Echinoplaca fusconitida* R. Lücking or to *E. marginata* (see below; Lücking 1997). I therefore suspect that the report of Vězda & Vivant is erroneous and that *G. argentea* is not (yet ?) reported from Basse-Terre.
- *E. leucotrichoides* (Vain.) R. Sant., a pantropical foliicolous species.
- *E. marginata* R. Lücking, a foliicolous species, just described from Costa Rica (Lücking 1997: 57-58), found on Basse-Terre, near the «Grand Étang».
- *E. pellicula* (Müll. Arg.) R. Sant., a pantropical foliicolous species.
- *E. similis* Kalb & Vězda, a corticolous species described from Brazil/Parana and Mato Grosso (Kalb & Vězda 1988: 27-28), is rather abundant on trees in Basse-Terre, between 450 and 700 m elev.
- *E. verrucifera* R. Lücking, a foliicolous species, just described from Costa Rica (Lücking 1997: 62-64), found at several localities on the southern parts of Basse-Terre, mainly on living leaves but also on wet bark and on rocks at stream level.
- *Gomphillus ophiosporus* Kalb & Vězda, a muscicolous species, known from Costa Rica and Ecuador (Kalb & Vězda 1988: 31) and recently found in Papua New Guinea (Aptroot et al. 1997: 66). Very abundant on terricolous or saxicolous mosses on the volcano «La Soufrière» on Basse-Terre, above 1100 m elev.
- *Gyalectidium caucasicum* (Elenk. & Woron.) Vězda, a pantropical foliicolous species, also found in suitable localities in SW Europe and in the Caucasus (Russia and Georgia).
- *G. filicinum* Müll. Arg., a pantropical foliicolous species but also found on rocks at stream level in Guadeloupe.
- *Gyalideopsis lambinonii* Vězda, a rare pantropical corticolous species, found only once in Basse-Terre, near the river «St-Jean» at 260 m elev.
- *G. rubescens* Vězda, a pantropical foliicolous species.
- *G. vainioi* Kalb & Vězda, a corticolous species previously known from Brazil (mainly S), Mexico and USA/Florida (Kalb & Vězda 1988: 51-54; Harris &

Fig. 11. *Gyalideopsis vivantii* (holotype) - a: bundles of conidiogenous cells and conidia (mounted in LCB), scale = 10 µm, b: sections through the apothecial margin (mounted in LCB), scale = 50 µm.

Wheeler 1988: 22). Found in abundance on bark on Basse-Terre, especially on low shrubs near the mountains summits around 600-700 m elev., also found in a collection from Tobago (Summit of Main Ridge near Pariatuvier, 29. IX. 1963, H. A. Imshaug 31683, LG, filed under *Ocellularia fecunda*). The hyphophores and apothecia of all the collections gathered in Guadeloupe and Tobago match quite well the original description except that the apothecial disc is never pruinose; I do not think that this discrepancy is worth any taxonomical rank. Also worth mentioning is the presence of algal cells in the conidial mass of the hyphophores (green, spherical cells, 8-12 µm in diam., with abundant aplanospores production), thus enabling both partners of the lichen to be dispersed together.

- *G. vulgaris* (Müll. Arg.) R. Lücking [= *Actinoplaca vulgaris* (Müll. Arg.) Vězda & Poelt], a foliicolous species found in the Neotropics.

- *Tricharia albostrigosa* R. Sant., a pantropical foliicolous species but also found on rocks at stream level in Basse-Terre.

- *T. couepiae* (Bat.) R. Lücking & Sérus. (= *T. dilatata* auct. neotrop., non Vězda). Lücking et al. (1998) have demonstrated that the neotropical populations referred to *T. dilatata* Vězda belong to a different taxon, for which the epithet *couepiae* is available.

- *T. longispora* Vězda, a foliicolous species known in SE Brazil and in Guatemala (Kalb & Vězda 1988: 69), also reported with doubt from Costa Rica (Lücking 1997: 84-85, with a «cf.»), found in small quantities along the river Quiock at 420 m elev.

- *T. heterella* (Stirt.) R. Lücking [= *T. membranula* (Müll. Arg.) R. Lücking = *Echinoplaca affinis* Kalb & Vězda; Lücking 1997: 82-83], a foliicolous species found in the Neotropics, abundant on leaves on Basse-Terre and once found on twigs.

- *T. papillifera* R. Lücking, a species just described as foliicolous from Costa Rica (Lücking 1997: 85-86), found twice on Basse-Terre on living leaves near the «Grand Etang» at 400 m elev and along the river Moreau, at c. 260 m elev. but much more abundant on decorticated bark and twigs between 260 and 700 m elev.

- *T. urceolata* (Müll. Arg.) R. Sant., a foliicolous species abundant in the Neotropics and also reported from E Africa.

- *T. vainioi* R. Sant., a pantropical foliicolous species.

Vězda & Vivant (1992: 278) have reported the following species from the nearby «Marie-Galante» Is.: *Actinoplaca strigulacea*, *A. vulgaris*, *Bullatina aspidota* (Vain.) Vězda, *Echinoplaca argentea* (Mont.) Vain. (see above), *E. campanulata* Kalb & Vězda ad int. (Kalb & Vězda 1988: 24), *E. epiphylla* Fée, *Gyalectidium filicinum* Müll. Arg., *Tricharia carnea* (Müll. Arg.) R. Sant., *T. urceolata* (Müll. Arg.) R. Sant. and *T. vainioi* R. Sant.

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This paper represents my contribution n°1 to the taxonomy and ecogeography of the lichenized fungi in the West Indies.

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