

Contribution to the Study of Lichens from Kivu (Zaire),
Rwanda and Burundi. VIII. New and Interesting
Species of Parmeliaceous Lichens

EMMANUËL SÉRUSIAUX

Chargé de Recherches au Fonds National de la Recherche Scientifique, Département de Botanique, Université de Liège, Sart Tilman, B-4000 Liège, Belgium

Abstract. Five new species of parmelioid lichens are described: *Bulbothrix haleana* Sérusiaux, a saxicolous species containing salazinic acid; *Parmotrema kahuziense* Sérusiaux, a large coriaceous species with small spores and protocetraric acid; *Parmotrema lambinonii* Sérusiaux, the assumed pustulate counterpart of *P. inexpectatum*; *P. subhanningtonianum* Sérusiaux, the sorediate counterpart of *P. hanningtonianum*; and *P. pseudounetum* Sérusiaux, which corresponds to *Parmelia euneta* auct. p.p., non Stirton. Two species are reported new for the African continent: *Hypotrachyna chlorina* (Müll. Arg.) Hale and *H. protenta* Hale. New localities are reported for the rare *Bulbothrix pustulata* (Hale) Hale, *Hypotrachyna sublaevigata* (Nyl.) Hale, *Parmotrema bangii* (Vainio) Hale and for *Pseudoparmelia inhaminensis* (Dodge) Hale. The following new combinations are made: *Parmotrema cooperi* (Steiner & Zahlbr.) Sérusiaux, *Parmotrema gardneri* (Dodge) Sérusiaux and *Parmotrema pseudograyanum* (Hale) Sérusiaux.

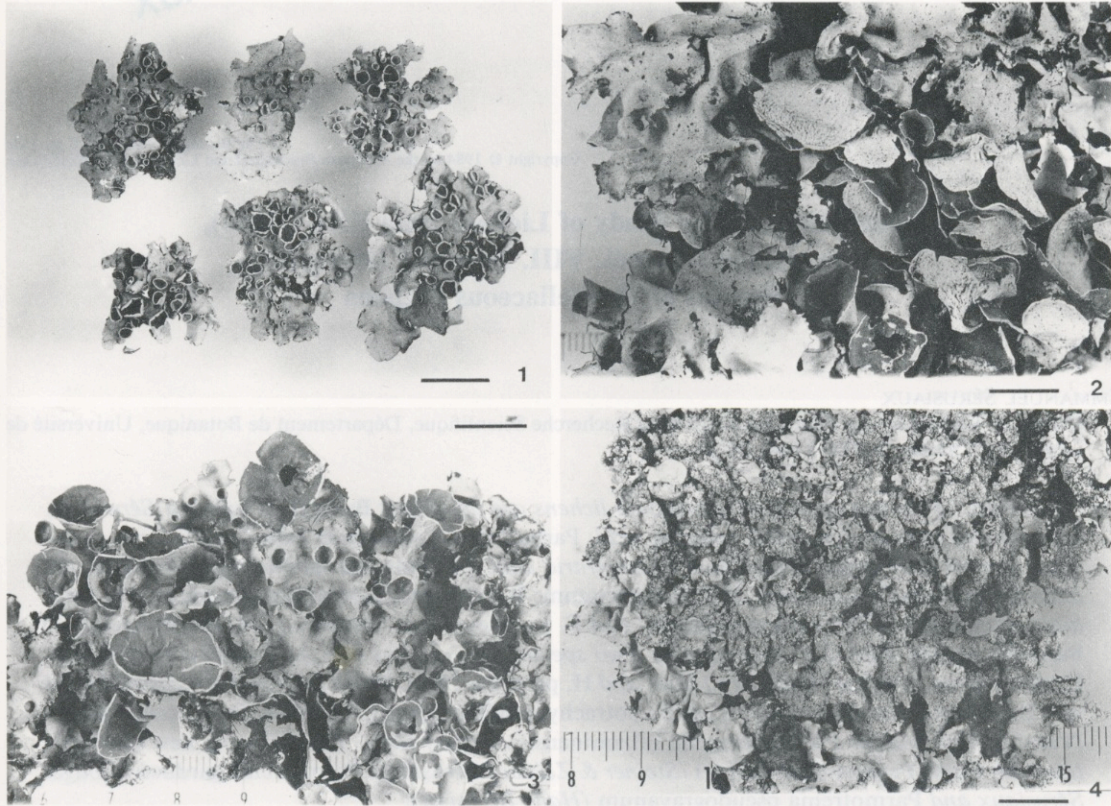
The genus *Parmelia* has been recently divided into a number of genera (Hale 1974a,b,c,d & 1976a; Esslinger 1978; Sipman 1980; W. Culberson & C. Culberson 1981; Krog 1982a) some of which have not been widely accepted by lichenologists, especially in Europe and Asia. The aim of this paper is not to reassess those new concepts but to deal with new and interesting parmeliaceous species found in east-central Africa. In spite of a few difficulties encountered in the circumscription of some of those segregate genera, however, I am convinced that *Parmelia* as it is usually accepted is a heterogenous assemblage and that further investigations will demonstrate the accuracy of the concepts first introduced by Hale. Krog (1982b) for example has conclusively used characters based on conidia to support some of the new genera. I therefore do not hesitate to use the new genera recognized within *Parmelia* s.l. to describe the species present in Kivu (Zaire), Rwanda and Burundi.

In a recent and very fascinating paper about the species pair concept in lichenology, Tehler (1982) argued that recognition of the species rank to "sorediate counterpart" of fertile species is without validity. His discussion unquestionably is coherent but is mainly based on theoretical assumptions and

moreover does not take into account what I believe is a phenomenon of wide occurrence in lichens—the formation of chimerae (the building of a single thallus by at least two genetically different fungi). It is not the aim of this paper to discuss those matters further; therefore, as long as no experimental evidence is provided, I believe that taxonomic workers should not change the traditional treatment of asexual taxa.

Parmeliaceous species, especially those belonging to *Parmotrema*, are one of the dominant groups of lichens in the tropics, and east-central Africa is no exception to this. Large and conspicuous species are very attractive and they have been frequently collected. Since 1971 extensive collections of lichens were made there by a trained lichenologist, Prof. J. Lambinon. The study of parmeliaceous species is now almost complete; this paper deals with the most interesting taxonomic results. A forthcoming paper will include a complete survey of all taxa present in the area.

The descriptions presented here are based solely on the material from east-central Africa. All the specimens cited have been analyzed by thin-layer chromatography (TLC) by means of standard methods (C. Culberson & Amann 1979; C. Culberson et



FIGURES 1-4. Parmeliaceous lichens from central Africa. — 1. *Bulbothrix haleana* Sérusiaux, holotypus, Lambinon 71/1356—LG. — 2. *Parmotrema kahuziense* Sérusiaux, holotypus, Lambinon 78/246—LG. — 3. *Parmotrema kahuziense* Sérusiaux, Lambinon 71/1166—LG. — 4. *Parmotrema lambinonii* Sérusiaux, Lambinon 74/928—LG. A small *Hypotrachyna* species is overgrowing the thallus. Rule = 1 cm for all.

al. 1981). Information about the area investigated and about its ecogeographical position is provided by Lambinon and Sérusiaux (1977).

BULBOTHRIX HALEANA Sérusiaux, sp. nov. FIG. 1

Thallus saxicola, laxe adnatus, 2-3 cm diam., rosulas formans. Lobi 1-3 mm lati, orbiculares, margine crenata, ciliis numerosis instructa, ciliis 0.3-0.5(-0.8) mm longis, basi bulbosis, superne grisei, plus minusve maculati, inferne plerumque pallide brunnei vel raro albidii. Rhizinae numerosae, usque ad 0.5-0.6 mm longae, plerumque brunneae praeter album apicem, simplices vel penicillatae. Medulla alba vel flavida. Apothecia numerosa, adnata, 1-3 mm diam., ecoronata, disco vulgo plano cum margine crenata-dissecta in veteribus apotheciis. Sporae ellipsoideae, 7-8 × 5-6 μm. Acidum salazinicum et atranorinum continens.

Thallus appressed but loosely adnate on rocks, forming small rosettes, 2-3 cm in diameter. Lobes 1-3 mm large, rounded, rather crowded, the margins crenate with numerous and conspicuous cilia, more or less strongly but sometimes indistinctly inflated at the base, simple or rarely branched, black, usually not shiny, 0.3-0.5(-0.8) mm long. Upper surface grey to yellowish glaucous, non maculate on young lobes, becoming more or less maculate else-

where, without any propagules. Lower surface pale brown, sometimes almost whitish; rhizines numerous, present up to the margins, up to 0.5-0.6 mm long, mostly brownish with a whitish tip but sometimes entirely black or very pale brown, simple or penicillate, rather blunt. Medulla white or rarely yellowish. Small black dots on the surface are probably pycnidia but no sterigmata or pycnidiospores have been seen. Apothecia very numerous, adnate, 1-3 mm in diameter, sometimes up to 5 mm, ecoronate; disc brown, usually plane, rarely concave; margin thin, becoming crenate-dissected in old apothecia. Spores 8 per ascus, ellipsoid to almost spherical, 7-8 × 5-6 μm. TLC: atranorin and salazinic acid.

Type: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, 2780 m, on rock, Lambinon 71/1356 (LG—holotype; US—isotype).

Other specimen examined: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, 2860 m, on rock, Lambinon 71/1306 (LG, o).

This species clearly belongs to *Bulbothrix* as circumscribed by Hale (1976c) because of its bulbate cilia at the lobe margins and its lack of usnic acid

in the cortex. Its saxicolous habitus (small loosely adnate rosettes), pale lower surface and very small spores set it apart from all previously known species. Small spores are rare in the genus: only *B. bulbochaeta* (Hale) Hale (a very rare species endemic to India), *B. chowoensis* (Hale) (a species endemic to the Zambesian region in Africa), *B. confoederata* (W. Culb.) Hale (a southeastern United States endemic) and *B. laevigatula* (Nyl.) Hale (a neotropical species) have spores about that size. As stated by Hale (1976c: 3), most *Bulbothrix* species with salazinic acid have much larger spores: *B. haleana* therefore is a remarkable exception.

The species has been collected twice on Kahuzi mountain in eastern Zaire, at an elevation of 2780 and 2860 m. It grows in a very rocky facies at the lowest part of the ericoid belt covering the tops of the mountain. Dominant shrubs are here *Erica kingaensis* subsp. *rugegensis* and *Philippia benguelensis*. For a more detailed description of this site, see Hendrickx (1946).

Bulbothrix pustulata (Hale) Hale

Phytologia 28: 480, 1974. *Parmelia pustulata* Hale, in Hale & Kurokawa, Contr. U.S. Natl. Herb. 36: 140, 1964. Type: Burundi, Ngozi, bamboo-thickets, 2100 m, on bamboo, *Deuse* s.n. (US!—holotype; LG!, O!, herb. Follmann!—isotypes).

Other specimen examined: RWANDA: East-central afro-montane district, Rugera, Uwagahunga, ±2350 m, on dead bamboo culm, *Lambinon* 74/1158 (LG).

This species was first collected in 1958 by P. Deuse, a Belgian botanist working in Rwanda-Burundi. Ramaut (1965) studied its chemistry and sent it to M. E. Hale who described it as new. The collection left in Liège was plentiful and therefore isotypes could be sent to O and to herb. Follmann. *Bulbothrix pustulata* is definitely a rare species: J. Lambinon, who has collected extensively in Rwanda and Burundi, gathered only one other rather poor specimen a few kilometers west of the type locality. Both collections were found in the same habitat: bamboo thickets in secondary outgrowths within the montane forest (for more information, see Lewalle 1972).

Bulbothrix pustulata is a very distinctive species: thallus membranous and fragile, long irregular lobes with short bulbate cilia at the margins, upper surface with dactyls (in the sense of Swinscow & Krog 1978) erupting without soredia formation, cortex elsewhere easily flaking off. Apothecia are very few (only one well developed in the LG isotype); they are adnate, up to 2 mm in diameter, with a brown disc and an eroded margin. Spores are ellipsoid and measure 14–16 × 8–9 μm.

Hypotrachyna chlorina (Müll. Arg.) Hale

Smithsonian Contr. Bot. 25: 28, 1975. *Parmelia chlo-*

rina Müll. Arg., Flora 63: 267, 1880. Type: Brazil, Deventer (G—lectotype).

Specimen examined: RWANDA: East-central afro-montane district, Sebeya valley W of Gikungu, ±2100 m, on dead trunk on ground, *Lambinon* 74/705 (LG, herb. Follmann, M, O, US).

It is with considerable hesitation that I refer this plentiful collection to *Hypotrachyna chlorina*, but the medullary chemistry (barbatic and 4-*O*-demethyl-barbatic acids with entothecin) and the lobules point to that species. However, in his monograph of the New World *Hypotrachyna*, Hale (1975) said that the species contains obtusatic acid (an acid not detected in the African material) and that the lobules are elongate, simple or furcate and rather irregular (Fig. 4e of Hale 1975). In our material, the lobules are very regular and could be described as a crenate margin; moreover, they bear rhizines. Nevertheless I do not think that these differences warrant a taxonomic status and, pending the discovery of new localities and more detailed study in the field, I refer this African collection to *Hypotrachyna chlorina*.

The species was formerly known only from the New World (West Indies, Panama, Venezuela, Peru and Brazil). It is new to Africa, growing on a dead fallen trunk in an almost undisturbed montane forest, on the lower parts of a hillslope, not far from the river. This locality is a "dark" part of the forest with high and constant humidity; *Lobaria*, *Pseudocyphellaria* and *Stictia* species are abundant in this habitat.

Hypotrachyna protenta Hale

Smithsonian Contr. Bot. 25: 58, 1976. Type: Venezuela, Merida State, El Valle, open forest along stream, on rocks, *Hale* 43365 (US—holotype; DUKE, TNS, UPS— isotypes).

Specimen examined: BURUNDI: East-central afro-montane district, Mt. Teza, ridge above the tea plantation, ±2500 m, on boulders, *Lambinon* 74/1428 (LG, US).

The African collection is plentiful and matches perfectly the type specimen as well as the numerous collections from Central and South America preserved at US. The sublinear and rather coriaceous lobes and the presence of alectoronic and α-collatolic acids in the medulla are the typical features of this species.

Hypotrachyna protenta is not rare in the mountains in Central and South America and is quite common in the Merida region in Venezuela. This is the first record for Africa and for the Old World. It grows on exposed outcrops on the highest summit in Burundi—Mt. Teza—which is covered by steppe grasslands (for more details, see Lewalle 1972).

***Hypotrachyna sublaevigata* (Nyl.) Hale**

Smithsonian Contr. Bot. 25: 66, 1975. *Parmelia tiliacea* var. *sublaevigata* Nyl., Syn. Lich. 1: 383, 1860. Type: South America, *Bonpland* (P—lectotype; H—Nyl. 35114—isolectotype).

Specimens examined: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, 2860 m, on rock, *Lambinon* 71/1306b (LG), 2780 m, on rock, *Lambinon* 71/1356b (LG).

Two scanty collections of *Hypotrachyna sublaevigata* have been found in the material examined. Some features raise doubts about their identity with that species: the typical South American populations are corticolous and contain norstictic acid in addition to salazinic acid. Norstictic acid has not been detected in the African material. Rhizines, lobe morphology, apothecia and spore size are, however, totally similar; these two discrepancies do not warrant the recognition of a distinct species. But more material could make additional differences come into light.

Awasthi (1976) was the first to report *H. sublaevigata* outside the New World, one corticolous collection from the Nilgiri Hills in India. Salazinic acid is the only substance detected in this specimen. Krog and Swinscow (1979) refer one small corticolous collection from Ethiopia. Their collection has the same lobe configuration as the one reported here but contains protolichesteric acid and skyrin in addition to salazinic acid. A specimen collected in Liberia by R. Santesson (Mt. Nimba, Cercle of N'Zérékoré, 1550 m, *Santesson* 10597c—US) can without doubt be identified as *H. sublaevigata*. It is corticolous and it contains salazinic acid.

In the area dealt with in this paper, *H. sublaevigata* occupies the same habitat as *Bulbothrix haleana* with which it grows.

***Parmotrema bangii* (Vainio) Hale**

Phytologia 28: 335, 1974. *Parmelia bangii* Vainio, in Schmidt, Bot. Tidsskr. 29: 104, 1909. Type: Bolivia, La Paz, *Bang*, Lichens of South America 13 (H—Nyl. 35500—lectotype).

Specimens examined: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, 2890 m, on bamboo culm, *Lambinon* 71/1312b (LG). RWANDA: East-central afro-montane district, Gikungu, Bikeneko valley, ±2150 m, on the liana *Schefflera myriantha*, *Lambinon* 74/474 (LG, US, herb. Follmann, herb. Vězda).

Parmotrema bangii is well characterized by a very fragile cortex, granular soralia developing from pustulate cracks of the cortex and the presence of stictic and constictic acids in the medulla. It has roughly the same morphology as *P. rimulosum* (Dodge) Hale and as *P. lambinonii* Sérusiaux from which it can be distinguished by the medullary chemistry: *P. rimulosum* contains alectoronic and α -collatolic acids and *P. lambinonii* contains the lividic acid complex.

In his world monograph of the genus, Hale (1965) mentioned only two localities in Bolivia and Colombia for this species. It was later discovered in Tenerife, Canary Islands (Østhagen & Krog 1976) and in Kenya (Krog & Swinscow 1981). I have seen a collection from Tanzania: Usambara Mts., Amani, 800–900 m, *Santesson* 23408 (US). A collection from Pernanbuco in Brazil was issued as *Parmelia bangii* in the Kurokawa Lichenes *Rariores et Critici Exsiccati* 230. The specimen in LG is a typical *Parmotrema crinitum* (Ach.) Choisy. In our area, it is rare, known from two localities: the bamboo forest of the Kahuzi-Biega range and the montane forest in Rwanda.

PARMOTREMA COOPERI (Steiner & Zahlbr.) Sérusiaux, comb. nov.

Parmelia cooperi Steiner & Zahlbr., in Zahlbruckner, Bot. Jahrb. Syst. 60: 528, 1926. Type: Afrique du Sud, Kapland, Kapprana, *Cooper*, 1813 (w—lectotype: H, M, UPS, US!—isotypes).

Specimens examined: ZAIRE: East-central afro-montane district, Virunga National Park, Kalongé (Butahu), ±2200 m, on dead branches on ground, *Frédéricq* in herb. *De Witte* 10307 (BR, cited by Hale 1965: 324), between Buronga and Kiberi marsh, 2190 m, *Louis* 5173 (BR). RWANDA: East-central afro-montane district, Virunga range, Rops plantation, ±2300 m, on *Eucalyptus*, *Lambinon* 72/726 (LG, US). Gikungu, Bikeneko valley, ±2150 m, on the liana *Schefflera myriantha*, *Lambinon* 74/475 (LG, M, TNS), 74/475b (LG, herb. Follmann, herb. Vězda) and 74/476 (LG, US). "Mission de Kigeme," ±2100 m, on trunk of *Bersama*, *Lambinon* 74/1008 (LG, O). BURUNDI: East-central afro-montane district, road Bujumbura-Ijenda, near Ruhororo, ±2000 m, on *Eucalyptus*, *Lambinon* 74/1184 (LG, herb. Follmann, M). Road Rushubi-Bugarama, Mwizinga, ±2030 m, on *Eucalyptus*, *Lambinon* 80/437 (LG, BM). Road Gakara-Mayuyu, Rurambira, ±2000 m, on *Eucalyptus*, *Lambinon* 80/161 (LG). Bururi forest, ±2100 m, on fallen branches, *Lambinon* 74/1300 (LG).

Hale (1965: 323) has correctly reduced *Parmelia segreganda* des Abb. to synonymy with this species. An isotype of *P. segreganda* preserved in LG is also a typical *P. cooperi*. It turns out that the combination in the genus *Parmotrema* of this epithet has never been made and is therefore made here.

Krog and Swinscow (1981) believe that *P. cooperi* is the sorediate counterpart of *P. holobum* (Hale) Hale. I agree with their arguments and would add that both species present the same variation in the presence of pruina on cilia and lobes. Awasthi (1976) described *Parmelia erhizinoso* from a single collection made in India: the only difference from *Parmotrema holobum* is said to be the absence of rhizines. Rhizines are few and scattered in this group; I would not rely on this single feature to characterize a new species and I consider *Parmelia erhizinoso* as doubtful.

Parmotrema cooperi is common in the tropical

African mountains east of the 28th meridian. It has been reported from India (Awasthi 1976) and Australia (Filson 1982). In our area it is a rather common epiphytic species, growing in the montane forests between 2000 and 2300 m elevation. It can survive the destruction of its habitat by colonizing the *Eucalyptus* plantations. It rarely bears apothecia: two specimens are fertile in the collections examined (*Lambinon* 74/1184, 74/476).

PARMOTREMA GARDNERI (Dodge) Sérusiaux, comb. nov.

Parmelia gardneri Dodge, Ann. Missouri Bot. Gard. 46: 179, 1959. Type: Brazil, Gardner s.n. (FH!—holotype).

Specimens examined: ZAIRE: Occidental rift valley district, Bishende island (Lake Kivu), ± 1470 m, on *Newtonia buchananii*, *Lambinon* 78/362b (LG). Ibid., in the canopy of a fallen tree, *Lambinon* 78/364 (LG, herb. Follmann, M). RWANDA: Rwanda and Burundi district, Butare, I.N.R.S. guest-house, ± 1700 m, on *Callistemon*, *Lambinon* 71/1021 (LG).

This species, as well as another similar European species, were previously known as *Parmelia dilatata* Vainio. Krog and Swinscow (1981) have cleared up the taxonomy of this difficult group. They show that the type collection of *Parmelia dilatata* contains atranorin and usnic acid in the cortex and protocetraric acid, echinocarpic acid and traces of yellowish pigments in the medulla. It matches perfectly *Parmelia affluens* Hale (1971), if one sets aside quantitative differences.

Parmotrema dilatatum (Vainio) Hale, non auct., is therefore easily distinguished from other sorediate and eciliate *Parmotrema* with protocetraric acid in the medulla by its more complex chemistry and by its spores reaching $25\text{--}27 \times 10\text{--}12 \mu\text{m}$ (in the other species they do not exceed $18\text{--}22 \times 8\text{--}10 \mu\text{m}$). The other species can be arranged as follows:

The *Parmotrema apricum* group, with two recently described species, one from Kenya, *Parmelia aprica* Krog & Swinscow (1981), the other from Tanzania, *P. vivida* Krog & Swinscow (1981). These species have not been found in our area.

The *Parmotrema dominicanum* group, with one species found in our area: *Parmotrema ravum* (see under that species).

The *Parmelia robusta* group comprises two closely related species: *Parmotrema robustum* (Degel.) Hale has a membranous thallus and a mainly Atlantic-Lusitanian distribution (Krog & Swinscow 1981), while *P. gardneri* has a coriaceous thallus and a pantropical distribution. I have studied material from western Europe (mainly from Brittany, France) and I agree that these specimens cannot be regarded as belonging to the same species as the African ones. The combination *Parmotrema gardneri* is therefore necessary.

Parmotrema gardneri is rare in our area: it has been found in two localities, one completely arti-

ficial and the other on the trunk and canopy of a fallen tree on the edge of a \pm disturbed forest. It is quite common in Shaba/Zaire (formerly Katanga) and in Northern Zambia from which I have seen numerous large collections with some specimens reaching 20 cm in diameter. Its habitat there is mainly the miombo (the *Brachystegia* woodland). Though much disturbed by clearing, this type of woodland (belonging to the Zambesian domain) is also present in the southern part of Burundi but *P. gardneri* was not collected there. *Parmotrema gardneri* also grows in the tree canopy of the Guineo-congolian region tropical forest: I have seen typical specimens from the Yangambi area in Zaire.

PARMOTREMA KAHUZIENSE Sérusiaux, sp. nov.

FIG. 2-3

Thallus corticola, coriaceous, laxe adnatus, usque ad 10-12 cm diam. Lobi 0.8-1.5 cm lati, primum orbiculares, postea crenati-incisi, ciliis 1-3 mm longis, superne grisei, emaculati, inferne nigri, praeter zonam marginalem brunneam. Rhizinae paucae, breves nigrae. Medulla alba. Pycnidiosporae sublageniformes, $6\text{--}8 \times 1 \mu\text{m}$ longae. Apothecia numerosa, stipitata, 1.5-2 cm diam., disco brunneo, perforato vel imperforato, cum margine dissecta in veteribus apotheciis. Asci 8-sporei; spores ellipsoideae, $(15\text{--})16\text{--}17 \times 8\text{--}10\text{--}(11) \mu\text{m}$. Ascidium protocetraricum et atranorium continens.

Thallus coriaceous, very loosely appressed and adnate on bark, forming large patches, up to 10(-12) cm in diameter. Lobes 0.8-1.5 cm broad, rounded when young, becoming crenate-dissected, cilia sparse but always distinct, 1-3 mm long, simple or forked, black, rather shiny and blunt, more or less flexuose. Upper surface ash-grey or grey, non or very faintly maculate. Lower surface black except for a dark brown marginal zone; rhizines few and unevenly scattered, short, coarse, simple or forked, black. Medulla white. Pycnidia very numerous, appearing as small black dots on the lobe submarginal zone. Pycnidiospores sublageniform (in the sense of Krog 1982b), $6\text{--}8 \times 1 \mu\text{m}$. Apothecia numerous, almost covering the thallus, 1.5-2.0 cm in diameter, mostly submarginal, stipitate, usually born on a swollen lobe, concave; disc chocolate brown, perforate or not; margin entire or irregularly dissected, almost torn when old; outer parts of the exciple strongly maculate, rugose. Spores 8 per ascus, ellipsoid, $(15\text{--})16\text{--}17 \times 8\text{--}10\text{--}(11) \mu\text{m}$ (including a $1 \mu\text{m}$ thick episporium). TLC: atranorin and protocetraric acid.

Type: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, ± 2260 m, on fallen branch in bamboo forest, *Lambinon* 78/246 (LG—holotype; US—iso-type).

Other specimen examined: ZAIRE: East-central afro-montane district, Kahuzi range, km 41 of the road Bukavu-Walikale, 2300 m, on fallen branch, *Lambinon* 71/1166 (LG, O).

Parmotrema kahuziense is a spectacular species and, owing to its large size, coriaceous thallus and black undersurface, looks like a representative of the *P. nilgherrense* (Nyl.) Hale group. It can, however, be easily distinguished by its nonmaculate cortex, spores and pycnidiospores and the presence of protocetraric acid in the medulla. In the *P. nilgherrense* aggregate, the cortex is very strongly maculate, spores are much bigger ($20\text{--}30 \times 10\text{--}15 \mu\text{m}$), conidia are filiform and, except for the occasional presence of norstictic acid, depsidones of the β -orcinol series are unknown within this group. No described species of *Parmotrema* falls near *P. kahuziense* and no sorediate or isidiate species can be assigned as the secondary morph.

Two collections of this species have been made in the Kahuzi mountains in eastern Zaire; both localities are near the margin of the montane forest and the unspoiled bamboo forest belt that covers those mountains between 2300 and 2700 m elevation; it grows probably in the canopy of the trees, a habitat as yet poorly investigated. For a description of this area, see Hendrickx (1946).

PARMOTREMA LAMBINONII Sérusiaux, sp. nov.

FIG. 4

Thallus corticola, membranaceus, adnatus, usque ad 8 cm diam. Lobi 0.3–0.6 cm lati, orbiculares, margine ciliis usque ad 4 mm longis instructa, superne grisei, emaculati, inferne nigri praeter zonam marginalem brunneam. Pustulae numerosae thalli superficiem omnino obtegentes, erosae et fractae sed nulla soredia formantes. Medulla alba. Pycnidia rara; pycnidiosporae non visae. Apothecia non visa. Acidum lividicum et substantias affines et atranorinum continens.

Thallus more or less membranous, rather appressed and adnate on bark or on twigs, forming patches up to 8 cm in diameter. Lobes 0.3–0.6 cm broad, rounded or slightly undulating; cilia sparse or locally abundant, especially in old parts, simple or irregularly forked, black, more or less shiny and flexuose, up to 4 mm long. Upper surface ash-grey to yellowish grey, nonmaculate, very fragile and flaking off. Pustules usually appearing on lobe submarginal zone but soon covering the whole surface and sometimes forming clusters; those pustules are rarely ciliate and old ones erupt without typical soredial formation. Lower surface black, except for a narrow dark brown marginal zone; rhizines few and unevenly scattered, short, coarse, black and usually simple. Medulla white. Pycnidia very rare, appearing as small dots on the lobe submarginal zone; pycnidiospores not seen. Apothecia unknown. TLC: atranorin and substances in the lividic acid group.

Type: ZAIRE: East-central afromontane district, Kahuzi range, Mukaba track, km 17, 2210 m, on tops of bamboo culms, *Lambinon 71/1195* (LG—holotype; US—iso-types).

Other specimens examined: ZAIRE: East-central afro-

montane district, Kahuzi range, near the Musisi marsh, 2180 m, on fallen branches (mainly *Kotschya*), *Lambinon 71/1149* (LG). RWANDA: East-central afromontane district, Rugege forest, W of the Kamiranzovu marsh, ± 1950 m, on mossy branches of *Syzygium*, *Lambinon 74/928* (LG).

The chemistry of this species is complex, as is usually the case with parmeliaceous species containing the lividic acid series, such as *Hypotrachyna formosana* (Zahlbr.) Hale and *H. immaculata* (Kurok.) Hale. No attempt has been made to determine all the spots detected on TLC plates but the following substances have been definitely identified: lividic acid, physodic and 4-*O*-demethylphysodic acid. The lividic acid complex is extremely rare among species of *Parmotrema*, otherwise known only from the African endemic *P. inexpectatum* (des Abb.) Hale (see Krog & Swinscow 1981). This contrasts strongly with its relative abundance in the genus *Hypotrachyna*. It is tempting to consider *Parmotrema lambinonii* as an asexual morph of *P. inexpectatum*; data on its pycnidiospores would be helpful in this regard.

Parmotrema lambinonii recalls *P. bangii*, *P. cryptoxanthum* (des Abb.) Hale and *P. rimulosum* (Dodge) Hale in its fragile and flaking upper cortex and in its laminal or submarginal and eroded pustules. These species can be easily distinguished by the chemical compounds in the medulla (Hale 1965; Krog & Swinscow 1981): *P. lambinonii* contains the lividic acid complex, *P. bangii* stictic acid, *P. cryptoxanthum* echinocarpic acid, protolichesterinic acid and a pale-pink pigment and *P. rimulosum* alecatoronic acid and α -collatolic acid. Small but diagnostic features in the pustules evolution are also helpful: *P. bangii* and *P. rimulosum* produce soredia; *P. cryptoxanthum* and *P. lambinonii* have eroded pustules that do not evolve into typical soredia.

The collection *Lambinon 74/928* is slightly parasitized by an undescribed species of *Pleoscutula* Vouaux very much like *P. arsenii* Vouaux, a species based upon a *Physcia* species from Mexico but with smaller spores, $6\text{--}8 \times 2 \mu\text{m}$.

Parmotrema lambinonii is a rare corticolous species found between 1950 and 2200 m. Two collections were made in undisturbed habitats, the lowest part of the bamboo belt of the Kahuzi-Biega mountains in Zaire and the Rugege forest in Rwanda. The collection *Lambinon 71/1149* came from a dense secondary bushland, dominated by *Kotschya africana*, that follows the destruction of the montane forest in the Kahuzi-Biega range.

PARMOTREMA PSEUDEUNETUM Sérusiaux, sp. nov.

FIG. 6–8

= *Parmelia euneta* auct. p.p., non Stirton.

Thallus corticola, membranaceus, laxe adnatus. Lobi

African mountains east of the 28th meridian. It has been reported from India (Awasthi 1976) and Australia (Filson 1982). In our area it is a rather common epiphytic species, growing in the montane forests between 2000 and 2300 m elevation. It can survive the destruction of its habitat by colonizing the *Eucalyptus* plantations. It rarely bears apothecia: two specimens are fertile in the collections examined (*Lambinon* 74/1184, 74/476).

PARMOTREMA GARDNERI (Dodge) Sérusiaux, comb. nov.

Parmelia gardneri Dodge, Ann. Missouri Bot. Gard. 46: 179, 1959. Type: Brazil, *Gardner* s.n. (FH!—holotype).

Specimens examined: ZAIRE: Occidental rift valley district, Bishende island (Lake Kivu), ±1470 m, on *Newtonia buchananii*, *Lambinon* 78/362b (LG). *Ibid.*, in the canopy of a fallen tree, *Lambinon* 78/364 (LG, herb. Follmann, M). RWANDA: Rwanda and Burundi district, Butare, I.N.R.S. guest-house, ±1700 m, on *Callistemon*, *Lambinon* 71/1021 (LG).

This species, as well as another similar European species, were previously known as *Parmelia dilatata* Vainio. Krog and Swinscow (1981) have cleared up the taxonomy of this difficult group. They show that the type collection of *Parmelia dilatata* contains atranorin and usnic acid in the cortex and protocetraric acid, echinocarpic acid and traces of yellowish pigments in the medulla. It matches perfectly *Parmelia affluens* Hale (1971), if one sets aside quantitative differences.

Parmotrema dilatatum (Vainio) Hale, non auct., is therefore easily distinguished from other sorediate and eciliate *Parmotrema* with protocetraric acid in the medulla by its more complex chemistry and by its spores reaching $25\text{--}27 \times 10\text{--}12 \mu\text{m}$ (in the other species they do not exceed $18\text{--}22 \times 8\text{--}10 \mu\text{m}$). The other species can be arranged as follows:

The *Parmotrema apricum* group, with two recently described species, one from Kenya, *Parmelia aprica* Krog & Swinscow (1981), the other from Tanzania, *P. vivida* Krog & Swinscow (1981). These species have not been found in our area.

The *Parmotrema dominicanum* group, with one species found in our area: *Parmotrema ravum* (see under that species).

The *Parmelia robusta* group comprises two closely related species: *Parmotrema robustum* (Degel.) Hale has a membranous thallus and a mainly Atlantic-Lusitanian distribution (Krog & Swinscow 1981), while *P. gardneri* has a coriaceous thallus and a pantropical distribution. I have studied material from western Europe (mainly from Brittany, France) and I agree that these specimens cannot be regarded as belonging to the same species as the African ones. The combination *Parmotrema gardneri* is therefore necessary.

Parmotrema gardneri is rare in our area: it has been found in two localities, one completely arti-

ficial and the other on the trunk and canopy of a fallen tree on the edge of a ± disturbed forest. It is quite common in Shaba/Zaire (formerly Katanga) and in Northern Zambia from which I have seen numerous large collections with some specimens reaching 20 cm in diameter. Its habitat there is mainly the miombo (the *Brachystegia* woodland). Though much disturbed by clearing, this type of woodland (belonging to the Zambesian domain) is also present in the southern part of Burundi but *P. gardneri* was not collected there. *Parmotrema gardneri* also grows in the tree canopy of the Guineo-congolian region tropical forest: I have seen typical specimens from the Yangambi area in Zaire.

PARMOTREMA KAHUZIENSE Sérusiaux, sp. nov.

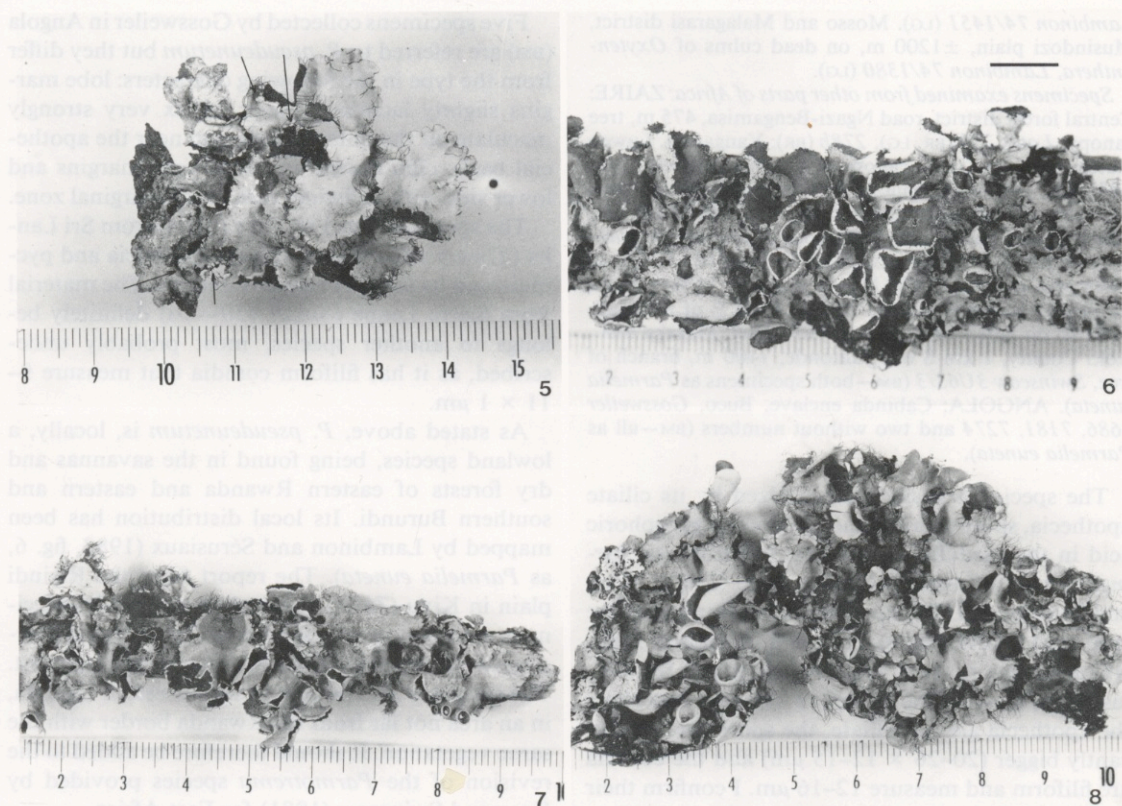
FIG. 2-3

Thallus corticola, coriaceus, laxe adnatus, usque ad 10-12 cm diam. Lobi 0.8-1.5 cm lati, primum orbiculares, postea crenati-incisi, ciliis 1-3 mm longis, superne grisei, emaculati, inferne nigri, praeter zonam marginalem brunneam. Rhizinae paucae, breves nigrae. Medulla alba. Pycnidiosporae sublageniformes, $6\text{--}8 \times 1 \mu\text{m}$ longae. Apothecia numerosa, stipitata, 1.5-2 cm diam., disco brunneo, perforato vel imperforato, cum margine dissecta in veteribus apotheciis. Asci 8-spori; sporae ellipsoideae, $(15\text{--})16\text{--}17 \times 8\text{--}10\text{--}(11) \mu\text{m}$. Acidum protocetraricum et atranorinum continens.

Thallus coriaceous, very loosely appressed and adnate on bark, forming large patches, up to 10(-12) cm in diameter. Lobes 0.8-1.5 cm broad, rounded when young, becoming crenate-dissected, cilia sparse but always distinct, 1-3 mm long, simple or forked, black, rather shiny and blunt, more or less flexuose. Upper surface ash-grey or grey, non or very faintly maculate. Lower surface black except for a dark brown marginal zone; rhizines few and unevenly scattered, short, coarse, simple or forked, black. Medulla white. Pycnidia very numerous, appearing as small black dots on the lobe submarginal zone. Pycnidiospores sublageniform (in the sense of Krog 1982b), $6\text{--}8 \times 1 \mu\text{m}$. Apothecia numerous, almost covering the thallus, 1.5-2.0 cm in diameter, mostly submarginal, stipitate, usually born on a swollen lobe, concave; disc chocolate brown, perforate or not; margin entire or irregularly dissected, almost torn when old; outer parts of the exciple strongly maculate, rugose. Spores 8 per ascus, ellipsoid, $(15\text{--})16\text{--}17 \times 8\text{--}10\text{--}(11) \mu\text{m}$ (including a $1 \mu\text{m}$ thick episporium). TLC: atranorin and protocetraric acid.

Type: ZAIRE: East-central afro-montane district, SW slope of Mt. Kahuzi, ±2260 m, on fallen branch in bamboo forest, *Lambinon* 78/246 (LG—holotype; US—iso-type).

Other specimen examined: ZAIRE: East-central afro-montane district, Kahuzi range, km 41 of the road Bukavu-Walikale, 2300 m, on fallen branch, *Lambinon* 71/1166 (LG, O).



FIGURES 5-8. Parmeliaceous lichens from central Africa. — 5. *Parmotrema subhanningtonianum* Sérusiaux, holotypus, *Lambinon* 72/208b—LG. Scale in cm. Arrows indicate the soredia. — 6-8. *Parmotrema pseudeunetum* Sérusiaux. — 6. *Lambinon* 74/1451—LG. Rule = 1 cm. — 7. *Lambinon* 72/181a—LG. Scale in cm. — 8. Holotypus, *Lambinon* 74/1461b—LG. Scale in cm.

0.4-0.8 cm lati, primum orbiculares, postea crenati-incisi, margine ciliis numerosis 3-6 mm longis instructa, superne grisei, emaculati, inferne nigri praeter zonam marginalem brunneam; rhizinae \pm numerosae, nigrae. Medulla alba. Pycnidiosporae sublageniformes, 6-8 \times 1 μ m longae. Apothecia numerosa, stipitata, 0.5-1.1(-1.7) cm diam., disco brunneo, perforato vel imperforato, cum margine ciliata. Asci 8-spори; sporaе ellipsoideae, 15-19(-20) \times (9-10)-12(-13) μ m. Acidum gyrophoricum et atranorinum continens.

Thallus coriaceus, very loosely appressed and adnate on bark, almost exclusively on twigs. Lobes 0.4-0.8 mm broad, rounded when young, rapidly but rarely deeply crenate-dissected, ascending and overcrowding each other; cilia extremely abundant, 3-6 mm long, sometimes up to 1 cm, rarely smaller, black, simple or forked, shiny, flexuose and more or less twisted, sometimes directly growing on the thallus surface. Upper surface ash-grey to grey, not or very faintly maculate. Lower surface black, except for a dark brown marginal zone; rhizines rather abundant but unevenly scattered, 0.2(-0.3) mm long, coarse, black, simple or forked, matt and mostly blunt, giving the undersurface a fluffy appearance where they are abundant. Pycnidia numerous, always present, appearing as small black dots on the

lobe submarginal zone. Pycnidiospores sublageniform to weakly sublageniform (in the sense of Krog 1982b), rarely rod-shaped, 6-8 \times 1 μ m. Apothecia usually present, 0.5-1.1(-1.7) cm in diameter, numerous, mostly submarginal, stipitate, usually born on a swollen lobe, concave; disc chocolate brown, perforate or not; margin crenate to dissected, or even lobulate, usually with abundant cilia (both eciliate and ciliate apothecia can occur on the same thallus); outer part of the exciple strongly maculate and rugose. Spores 8 per ascus, ellipsoid, 15-19(-20) \times (9-10)-12(-13) μ m (including a 1 μ m thick episporium). TLC: atranorin and gyrophoric acid.

Type: BURUNDI: Rwanda and Burundi district, Kinazi (between Cankuzo and Muhinga), \pm 1400 m, on branches of *Entada abyssinica*, *Lambinon* 74/1461b (LG—holotype; o, us—isotype).

Other specimens examined: RWANDA: Rwanda and Burundi district, Akegema National Park, SW of Ihema lake, \pm 1300 m, on branches of *Acacia brevispica*, *Lambinon* 72/181a (LG). BURUNDI: Rwanda and Burundi district, Kinazi, ridge between the Ruvubu and the Chizanye river, \pm 1400 m, on branch of *Entada abyssinica*, *Lambinon* 78/418 (LG). Remera (between Cankuzo and Muhinga), \pm 1400 m, on fallen branch of *Eucalyptus*,

Lambinon 74/1451 (LG). Mosso and Malagarasi district, Musindozi plain, ± 1200 m, on dead culms of *Oxytenanthera*, *Lambinon 74/1380* (LG).

Specimens examined from other parts of Africa: ZAIRE: Central forest district, road Ngazi-Bengamisa, 475 m, tree canopy, *Louis 278* (BR, LG), *278b* (BR). Yangambi, Luweo plateau, ± 470 m, in the canopy of a *Pterygopodium*, *Louis 6871* (BR, LG), in the canopy of a *Strombosiosis*, *Louis 6541* (BR, LG), branch of *Strombosia*, *Louis 6678* (BR, LG), "réserve flore Isalowe," in the canopy of *Strombosia glaucescens*, *Louis 8675* (BR, LG) (cited by Hale 1965: 325, as *Parmelia euneta*). UGANDA: Ankole, Mbara dist., Kantsyore Island in Kagera river, 13 km E of Kibagati, 4200 ft, on fallen twig, *Burnet 1919* (BM). Masaka dist., Koki County, 1 km S of Lyantonde, 1100 m, branch of tree, *Swinscow 3U63/3* (BM—both specimens as *Parmelia euneta*). ANGOLA: Cabinda enclave, Buco, *Gossweiler 6686*, *7181*, *7274* and two without numbers (BM—all as *Parmelia euneta*).

The species is easily characterized by its ciliate apothecia, spore size and the presence of gyrophoric acid in the medulla. It was first identified as *Parmelia euneta* Stirton following Hale (1965). Krog and Swinscow (1981) however have shown that the type (BM) is identical to *Parmelia composita* Hale, which belongs to the *P. nilgherrensis* group: the thallus is coriaceous, the cortex is strongly maculate, the apothecia are not ciliate, the spores are significantly bigger ($20\text{--}26 \times 12\text{--}15 \mu\text{m}$) and the conidia are filiform and measure $12\text{--}16 \mu\text{m}$. I confirm their statement; the species discussed here is unquestionably new. Specimens referable to the *Parmelia nilgherrensis* complex (*P. nilgherrensis* Nyl., *P. schimperi* Müll. Arg., *P. composita* Hale, *P. spilota* Hale and *P. diversa* Hale) are also present in the area concerned by this paper: they were collected in montane forests between 2100 and 2800 m elevation. On the contrary, *Parmotrema pseudeunetum* is a lowland species, never occurring above 1400 m elevation and present in savannas and dry woodlands.

Hale (1965: 325) reports *Parmelia euneta* from Haïti, Sierra Leone, Angola, Zaire and Sri Lanka. I have been able to study some of those collections. The specimen from Zaire is a part of a large collection made by Prof. J. Louis around Yangambi where *P. pseudeunetum* is not rare. Careful examination reveals subtle differences between the collections of *P. pseudeunetum* from Rwanda and Burundi and those from the Yangambi area: the latter tend to have a more maculate cortex, mainly near the base of the apothecia, they are less ciliate, especially the apothecial margin and their spores are a little bit longer: $16\text{--}22 \times 8\text{--}13 \mu\text{m}$ (average $19.4 \times 9.8 \mu\text{m}$, $N = 79$) for the specimens from Yangambi and $15\text{--}20 \times 9\text{--}13 \mu\text{m}$ (average $17.4 \times 10.2 \mu\text{m}$, $N = 93$ spores) for the specimens from Rwanda and Burundi. Further studies might show they belong to a different species.

Five specimens collected by Gossweiler in Angola (BM) are referred to *P. pseudeunetum* but they differ from the type in the following characters: lobe margins slightly lacinate, upper cortex very strongly maculate on the outer exciple and near the apothecial basis, cilia absent on the exciple margins and lower side with a distinct pale ivory marginal zone.

The specimen cited by Hale (1965) from Sri Lanka (*Tiwary* s.n.—BM) is without apothecia and pycnidia and its identity remains unclear. The material from Sierra Leone (*Small 450*—BM) definitely belongs to another species, most probably undescribed, as it has filiform conidia that measure $9\text{--}11 \times 1 \mu\text{m}$.

As stated above, *P. pseudeunetum* is, locally, a lowland species, being found in the savannas and dry forests of eastern Rwanda and eastern and southern Burundi. Its local distribution has been mapped by Lambinon and Sérusiaux (1983, fig. 6, as *Parmelia euneta*). The report from the Rwindi plain in Kivu (Zaire) is based on a doubtful specimen, morphologically similar to *Parmotrema abessinicum* (Krempelh.) Hale but chemically aberrant. The species is also present in southwestern Uganda, in an area not far from the Rwanda border with the same vegetation. It should therefore be added to the revision of the *Parmotrema* species provided by Krog and Swinscow (1981) for East Africa.

PARMOTREMA PSEUDOGRAYANUM (Hale) Sérusiaux, comb. nov.

Parmelia pseudograyana Hale, *Phytologia* 27: 2, 1973.

Type: South Africa, Natal, Drakensberg, Cathedral Peak area, Nhlonhlo Valley, 1500 m, *Schelpé 1021* (BOL—holotype; US!—isotype).

Specimens examined: RWANDA and Burundi district, Gakoma, ± 1450 m, ridge near the post, on boulders, *Lambinon 80/275* (LG, US). BURUNDI: Mosso and Malagarasi district, Gitwenge, Gatuntu hill, ± 1750 m, on boulders, *Lambinon 80/542* (LG, US, O), *80/542b* (LG, herb. Follmann, M).

As stated by Hale (1973) in the original description and by Krog and Swinscow (1981), *Parmotrema pseudograyanum* is close to *P. grayanum* (Hue) Hale from which it can be distinguished by its medullary chemistry: *P. pseudograyanum* contains two depsidones of the β -orcinol series (protocetraric and fumarprotocetraric acids) and *P. grayanum* contains aliphatic acids of the protolichesterinic group. *Parmotrema pseudograyanum* is here reported fertile for the first time. Apothecia are present in the collection *Lambinon 80/542*; they are adnate to substipitate, concave, measure up to 5 mm in diameter, the disc is chocolate brown and perforate, the margin is slightly crenate and dissolves into soralia as well as the upper thalline exciple; spores are

ellipsoid and measure (14–)15–18 × (6–)7–9 μm (including a 1 μm-thick episporium). The epithet has never been transferred to *Parmotrema*: therefore the formal combination is made here.

Parmotrema pseudograyanum is a saxicolous species endemic to Africa, being known from Ethiopia, Kenya, Uganda, Rwanda, Burundi, Tanzania, Angola and Natal in South Africa. In the area dealt with in this paper, it has been collected in two xerophilous localities. The collections *Lambinon 80/542* and *80/542b* were made in the *Julbernardia* woodland: for a detailed description of this biotope, see Reekmans (1981).

***Parmotrema ravum* (Krog & Swinscow) Sérusiaux in Vězda**

Lich. Sel. Exsicc. fasc. 75, n° 1857, 1983. *Parmelia rava* Krog & Swinscow. Bull. Brit. Mus. (Nat. Hist.), Bot., sér. 8, 9: 207, 1981. Type: Ethiopia, Sidamo Province, 5 km NW of Zenbe Woha, open woodland, 1770 m, *Krog E 12/5* (o—holotype; BM!, UPS—isotypes). = *Parmelia dominicana* auct. afric. p.p., non Vainio.

Specimens examined: RWANDA: East-central afro-montane district, "Mission de Kigeme," ±2100 m, on trunk, *Lambinon 74/1004* (LG). Rwanda and Burundi district, Akegera National Park, track between the lakes Rwanga-Kizinga and Mihindi, ±1350 m, on *Euphorbia candelabrum*, *Lambinon 72/153* (LG). BURUNDI: Rwanda and Burundi district, Kwitaba, 1800 m, on *Eucalyptus*, *Reekmans 6811/a* (LG). Bukirasazi, 1700 m, on *Eucalyptus*, *Reekmans 4704* and *4705* (LG). Rusengo, ±1700 m, on *Cupressus*, *Lambinon 80/636* (LG). Mosso and Malagarasi district, Gitwenge, Gatuntu hill, ±1750 m, on main branches of *Ozoroa reticulata*, *Lambinon 80/514* (LG, US), on main branches of *Lannea*, *Lambinon 80/520* (LG, herb. Follmann), on trunk of *Garcinia huillensis*, *Lambinon 80/524* (LG, herb. Vězda), main branches of *Parinari mobola*, *Lambinon 80/526* (LG), main branches of *Monotes elegans*, *Lambinon 80/538* (Vězda, Lich. Sel. Exsicc. 1857, LG), *80/539* (LG) and *80/539b* (LG), on boulder, *Lambinon 80/543* and *80/543b* (LG), Muzire, ±1750 m, on *Ficus*, *Lambinon 80/499* (LG, BM, TNS), Niabitangu hill, ±1800 m, on *Entada abyssinica*, *Lambinon 80/549* (LG). Ruyigi, on bark, *Michel and Reed 2205* (BR). Near Gihofi, ±1250 m, on main branches of *Erythrina*, *Lambinon 74/1397* (LG, M). Hills N of Rumonge, km 71 of the road Bujumbura-Rumonge, ±800 m, on *Brachystegia spiciformis*, *Lambinon 74/1230* (LG). Road Rumonge-Bururi, 10 km of Rumonge, ±950 m, on *Brachystegia*, *Lambinon 74/1249* (LG, herb. Follmann, US). Gitwe, road Rumonge-Bururi, 10 km of Rumonge, ±1000 m, on branches of *Faurea*, *Lambinon 78/522b* (LG).

This species has appeared in the literature dealing with African *Parmotrema* as *Parmelia dominicana* Vainio. Winnem (1975) was the first author to acknowledge the differences between the typical populations (which are from southeastern U.S.A., Mexico and the Caribbean region) from the African ones. In New World populations, usnic acid is concentrated in the soralia, thus there is a rather sharp contrast between the ash-grey cortex and the yellow-

green soralia. In African populations, usnic acid is produced in the cortex as well as in the soralia. Krog and Swinscow (1981) also have shown a sharp difference in pycnidiospores. In American specimens, they are sublageniform and measure 6–7 μm; in African ones, they are filiform and measure 10–12 × 1 μm. I have checked the criteria in a collection of *Parmotrema dominicanum* (Vainio) Hale made by Hale in Dominica (*Hale 35785*—US) and therefore I do not hesitate to follow Krog and Swinscow's treatment.

In some collections soralia are dark-grey. This is due to an *Arthonia*-like fungus that produces highly carbonized hyphae inside the soralia and that forms extremely small black apothecia (0.05 mm in diameter) on the surface. Spores are 8 per ascus, 1-septate, macrocephalic and constricted at the septum and measure 7–10 × 2–4 μm.

Parmotrema ravum is a common species in the Mosso and Malagarasi district. It is mainly epiphytic but also grows on rocks where accessibility (in the sense of Heimans 1954, applied to the lichens by Lambinon 1968) is high. Its colonies on the trunks of the *Brachystegia* or *Julbernardia* woodland are a main feature of the epiphytic community of this type of forest. Outside this district, it was found principally in the Akagera savannas and in artificial plantations in the Rwanda and Burundi district; its distribution pattern (map in Lambinon and Sérusiaux 1983, fig. 5) shows that the species requires well-lit habitats and that it can take advantage of the forest "opening" to penetrate into the montane forest belt. *Parmotrema ravum* is an African endemic, being common in the Zambezi domain but also present in East Africa northwards to Ethiopia. It has not yet been reported from West Africa.

PARMOTREMA SUBHANNINGTONIANUM Sérusiaux, sp. nov. FIG. 5

Thallus corticola, ± coriaceous, adnatus, 4 cm diam. Lobi 0.5–1.4 cm lati, primum orbiculares, postea crenati, margine ciliis numerosis, 2–4 mm longis instructa, superne grisei et maculati, inferne brunnei, perrugati, agglomeratis granulis fuscatis; rhizinae paucae, breves, brunneae. Medulla alba. Soralia rara, submarginalia, subcapitata et ± convexa. Pycnidia et apothecia non visa. Atranorinum et acidum gyrophoricum continens.

Thallus more or less coriaceous, moderately appressed and adnate on bark, forming small patches of 4 cm in diameter. Lobes 0.5–1.4 cm broad, rounded when young, soon becoming crenate with an ascending margin; cilia abundant, 2–4 mm long, black, dull or with a faint bluish pruina at the base, simple or irregularly forked, blunt and usually flattened. Upper surface grey, minutely but distinctly maculate. Lower surface brown to pale brown,

strongly rugose and wrinkled, with agglomerated dark granules; rhizines few and unevenly scattered, short, coarse, simple or penicillate, brown to pale brown or translucent. Soralia not very abundant, born submarginally or rarely marginally, subcapitate and more or less convex; soredia granular. Medulla white. Pycnidia and apothecia not seen. TLC: atranorin and gyrophoric acid.

Type: RWANDA: Rwanda and Burundi district, Butare, arboretum Ruhande, ±1700 m, on trunk of *Widdringtonia schwarzii*, Lambinon 72/208b (LG—holotype).

The type and only collection of *Parmotrema subhanningtonianum* is rather scanty, but the under-surface is absolutely identical to that of *P. hanningtonianum*; I do not hesitate to consider it as the sorediate counterpart of that species. Consistent data on pycnidiospores are unfortunately not available; they would of course be welcome to confirm this statement.

Parmotrema subhanningtonianum has been collected in a completely artificial habitat in Rwanda and also on the trunk of an introduced tree species. Its ecological requirements cannot therefore be circumscribed. Two arguments for its natural occurrence in Africa can nevertheless be presented. *Parmotrema hanningtonianum* is indigenous locally (although being known only from the Mosso-Malagarasi district in Burundi) and all other lichen species growing with *P. subhanningtonianum* are also indigenous.

Pseudoparmelia inhaminensis (Dodge) Hale

Phytologia 29: 190, 1974. *Parmelia inhaminensis* Dodge, Ann. Missouri Bot. Gard. 46: 130, 1959. Type: Angola, Inhamine, *Sousa* (BM!—holotype).

Specimen examined: ZAIRE: Occidental rift valley district, Virunga National Park, road between Mabenga and May ya Moto, ±1000 m, branches of *Olea africana*, Lambinon 72/631 (LG).

The only collection referred here to *Pseudoparmelia inhaminensis* is very scanty but the upper cortex and the medullary chemistry (stictic and constictic acids) leave no doubt about its identity. Material with pycnidia and apothecia would of course be welcome to confirm this identification.

Pseudoparmelia inhaminensis is an extremely rare species endemic to Africa, formerly known from two collections from Angola (Hale 1976b). It has not been found in the extensive collections from Shaba (Zaire) and Northern Zambia that I have examined. In the area studied here, it has been collected in a xerophilous thicket of the Rwindi-Rutshuru plain (see Lebrun 1947 for a complete description). These thickets are dense and intricate, formed by *Olea africana*, *Maerua triphylla* var. *jo-*

hannis, *Carissa edulis*, *Capparis tomentosa*, *Grewia similis*, *Euclea schimperi* and cactiform *Euphorbia*; they are believed to be the climax association. They are a very favorable habitat for lichens (Parmeliaceae, Physciaceae, Collemataceae and Stictaceae).

I want to thank very sincerely Prof. J. Lambinon who has placed his collections at our disposal, and who read this manuscript and made valuable comments. The TLC analyses have been performed in the Laboratory of Prof. J. L. Ramaut of Liège University; his help is gratefully acknowledged. Dr. M. E. Hale's warm welcome during my stay at the Smithsonian Institution in 1981 has been very encouraging. He gave me access to most valuable unpublished data and to his rich collections of parmeliaceous taxa from all over the world; he examined most critical taxon encountered in the material and improved substantially my manuscript. It gives me considerable pleasure to thank him here. I sincerely thank Dr. V. Demoulin and Dr. H. Krog for their interesting advice. I also thank the following botanists and institutions for the gift or the loan of collections: Prof. J. L. De Sloover, Prof. M. Reekmans, Prof. J. J. Symoens, Prof. C. Vanden Berghen, BM, BR and US.

- Awasthi, D. D.** 1976. Lichen genus *Parmelia* in India. I—Subgenera *Parmelia* and *Amphigymnia*. *Biological Memoirs* 1 [Lucknow, India] (1 & 2): 155–229.
- Culberson, C. F. & K. Amann.** 1979. Standard method zur Dünnschichtchromatographie von Flechtensubstanzen. *Herzogia* 5: 1–24.
- , **W. L. Culberson & A. Johnson.** 1981. A standardized TLC analysis of β -orcinol depsidones. *THE BRYOLOGIST* 84: 16–29.
- Culberson, W. L. & C. F. Culberson.** 1981. The genera *Cetrariastrum* and *Concamerella* (Parmeliaceae): a chemosystematic synopsis. *THE BRYOLOGIST* 84: 273–314.
- Esslinger, T. L.** 1978. A new status for the brown *Parmeliae*. *Mycotaxon* 7: 45–54.
- Filson, R. B.** 1982. A contribution on the genus *Parmelia* (Lichens) in Southern Australia. *Australian Journal of Botany* 30: 511–582.
- Hale, M. E., Jr.** 1965. A monograph of *Parmelia* subgenus *Amphigymnia*. *Contributions from the United States National Herbarium* 36: 193–358.
- , 1971. *Parmelia affluens*, a new species of lichen in subgenus *Amphigymnia* with a yellow medulla. *Phytologia* 22: 141–142.
- , 1973. New *Parmeliae* (lichens) from Africa. 2. *Phytologia* 27: 1–6.
- , 1974a. New combinations in the lichen genus *Parmotrema* Massalongo. *Phytologia* 28: 334–339.
- , 1974b. Delimitation of the lichen genus *Hypotrachyna* (Vainio) Hale. *Phytologia* 28: 340–342.
- , 1974c. *Bulbothrix*, *Parmelina*, *Relicina* and *Xanthoparmelia*, four new taxa in the Parmeliaceae (Lichenes). *Phytologia* 28: 479–490.
- , 1974d. New combinations in the lichen genus *Pseudoparmelia* Lyngé. *Phytologia* 29: 188–191.
- , 1975. A revision of the lichen genus *Hypotrachyna* (Parmeliaceae) in tropical America. *Smithsonian Contributions to Botany* 25, 73 pp.
- , 1976a. Synopsis of a new lichen genus *Everniastrum* Hale (Parmeliaceae). *Mycotaxon* 3: 345–353.
- , 1976b. A monograph of the lichen genus *Pseudoparmelia* Lyngé (Parmeliaceae). *Smithsonian Contributions to Botany* 31, 62 pp.

- . 1976c. A monograph of the lichen genus *Bulbothrix* Hale (Parmeliaceae). *Smithsonian Contributions to Botany* 32, 29 pp.
- . 1976d. A monograph of the lichen genus *Parmelina* Hale (Parmeliaceae). *Smithsonian Contributions to Botany* 33, 60 pp.
- Heimans, J. 1954. L'accessibilité, terme nouveau en phytogéographie. *Vegetatio* 5-6: 142-146.
- Hendrickx, F. 1946. Esquisse de la végétation du Kahuzi. *Revue d'Agronomie Coloniale, Bukavu* 3^e Trimestre 1946: 25-32.
- Krog, H. 1982a. *Punctelia*, a new lichen genus in the Parmeliaceae. *Nordic Journal of Botany* 2: 287-292.
- . 1982b. Evolutionary trends in foliose and fruticose lichens of the Parmeliaceae. *Journal of the Hortori Botanical Laboratory* 52: 303-311.
- & T. D. V. Swinscow. 1979. *Parmelia* subgenus *Hypotrachyna* in East Africa. *Norwegian Journal of Botany* 26: 11-43.
- & ———. 1981. *Parmelia* subgenus *Amphigymnia* (lichens) in East Africa. *Bulletin of the British Museum (Natural History), Botany Series* 9: 143-231.
- Lambinon, J. 1968. Anomalies écologiques et accessibilité: l'exemple de quelques lichens de Belgique et du Luxembourg. *Nova Hedwigia* 16: 403-407.
- & E. Sérusiaux. 1977. Contribution à l'étude des lichens du Kivu (Zaïre), du Rwanda et du Burundi. I. Introduction. Genres *Everniopsis*, *Normandina* et *Placopsis*. *Bulletin du Jardin Botanique National de Belgique* 47: 459-471.
- & ———. 1983. Contribution à l'étude des lichens du Kivu (Zaïre), du Rwanda et du Burundi. VII. Approche éco-géographique de la flore et de la végétation lichéniques dans l'Est de l'Afrique centrale. *Bothalia* 14: 533-538.
- Lebrun, J. 1947. *La végétation de la plaine alluviale au sud du lac Edouard. Exploration du Parc National Albert, Mission J. Lebrun (1937-1938). I.* Institut des Parcs Nationaux du Congo Belge, Bruxelles.
- Lewalle, J. 1972. Les étages de végétation du Burundi occidental. *Bulletin du Jardin Botanique National de Belgique* 42: 1-247.
- Østhaugen, H. & H. Krog. 1976. Contribution to the lichen flora of the Canary Islands. *Norwegian Journal of Botany* 23: 221-242.
- Ramaut, J. L. 1965. Etude chimique de quelques *Parmelia* tropicaux de la section *Amphigymnia*. *Revue Bryologique et Lichénologique* 33: 587-591.
- Reekmans, M. 1981. Les forêts à *Julbernardia globiflora* de l'est du Burundi. *Bulletin de la Société Royale de Botanique de Belgique* 114: 49-60.
- Sipman, H. J. M. 1980. Studies on Colombian cryptogams. X. The genus *Everniastrum* Hale and related taxa (Lichenes). *Proceedings Koninklijke Nederlandse Akademie van Wetenschappen, Ser. C* 83: 333-354.
- Swinscow, T. D. V. & A. Krog. 1978. The genus *Dirinaria* in East Africa. *Norwegian Journal of Botany* 25: 157-168.
- Tehler, A. 1982. The species pair concept in lichenology. *Taxon* 31: 708-717.
- Winnem, B. 1975. *Parmelia* subgenus *Amphigymnia* in Ethiopia. *Norwegian Journal of Botany* 22: 139-166.