The Parmelia borreri group (lichenized Ascomycetes) in Switzerland

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The *Parmelia borreri* group (lichenized Ascomycetes) in Switzerland

Camille Truong[1] and Philippe Clerc[2]

[1] Laboratoire de Botanique évolutive, Université de Neuchâtel, Rue Emile-Argand 11, CH-2007 Neuchâtel
[2] Conservatoire et Jardin botaniques de la Ville de Genève, Chemin de l'Impératrice 1, Case Postale 60, CH-1292 Chambésy/GE; e-mail: philippe.clerc@cjb.ville-ge.ch

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Abstract

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The morphology, chemistry and anatomy as well as distribution and ecology of *Parmelia borreri*, *P. stictica*, *P. subrudecta* and *P. ulophylla* in Switzerland are discussed. A key, and a distribution map for Switzerland are presented for each species. *Parmelia ulophylla* is confirmed to be a separate taxon from *P. subrudecta*. The differences (ecology and pycnidiospore length) between *P. stictica* and *P. borreri* are highlighted.

Key words: Lichens, *Parmelia subrudecta*, *P. stictica*, *P. ulophylla*, *P. borreri*, Switzerland, taxonomy, distribution.

Introduction

The *Parmelia borreri* group consists of foliaceous species characterized by the presence of a grey upper cortex displaying suborbicular pseudocyphellae and containing atranorin. The genus *Punctelia* subgenus *Punctelia* was created by Krog (1982) to segregate this group from the large genus *Parmelia* s. l. Since the first modern revision by Hale (1965), the characters used to separate the species in this group have been tested many times (Targé et Lambinon 1965, Krog 1970, Krog and Swinscow 1977, Roux 1985, Wilhelm and Ladd 1987, Elix 1994, Adler and Ahti 1996, Longan et al. 2000) and the validity of the taxa challenged. Recently, Herk and Aptroot (2000) provided some evidence that *Parmelia subrudecta* consists of two taxa and they resurrected the name "*ulophylla*" at the species level, mainly on the basis of the position of the soralia and the pruinosity of the margin.

In Switzerland, Frey (1959) recognized only one species, *Parmelia dubia* nom. illeg. with two varieties: var. *ulophylla* and var. *stictica*. Moreover, in the recently published Red Data List of lichens of Switzerland (Scheidegger et al. 2002), the corticolous species of this group were all lumped together under *Parmelia subrudecta* aggr.

The purpose of this work was to clarify the situation of the species of the *Parmelia borreri* group in Switzerland, discussing the morphology, the anatomy, the chemistry as well as the ecology and the distribution of each species occuring in this country.

Materials and Methods

Herbarium collections from G (including the Ed. Frey collection) and Z were investigated. Field work was conducted around Geneva and Neuchâtel. Pycnidia were removed from the lichen with a razor blade after softening the material with a drop of water. Squash preparation of pycnidia were mounted in water and examined with a Dialux 22 Leitz microscope. Measurements of conidia were made with an oil-immersion lens at 1000×. Chemistry was tested by thin-layer chromatography, using the method described in Culberson and Ammann (1979), with the solvent B modified according to Culberson and Johnson (1982). Mapping was done using ArcView GIS 3.2. (Environmental Systems Research Institute, California, USA).

Key to species

1 Lower surface dark brown to black and/or darkening toward the center of the thallus. Gyrophoric ± lecanoric acids **2**
Lower surface brown to pale brown and/or lighter toward the center of the thallus. Lecanoric acid (gyrophoric acid absent) **3**

2 Conidia bacilliform, 4–6 µm long. Thallus grey to bluish grey. Lobes broad, contiguous and ± adnate. Corticolous ***P. borreri***
Conidia filiform, 9–15 µm long. Thallus brownish grey to brown. Lobes narrow, distinctly overlapping and ± loose at the extremities (european specimens). Saxicolous ***P. stictica***

3 Soralia mainly laminal. Thallus margins not pruinose, usually shiny ***P. subrudecta***
Soralia mainly marginal, along secondary lobes. Thallus margins pruinose, usually mat ***P. ulophylla***

The species

***Parmelia borreri* (Sm.) Turner** Trans. Linn. Soc. 9:148 (1808). - *Lichen borreri* Sm., in Sm. & Sowerb., Engl. Bot. 25: 1789 (1807). Type: Sussex, W. Borrer (BM, holotype). *Punctelia borreri* (Sm.) Krog. *Parmelia dubia* auct. pro parte. *Parmelia pseudoborreri* Asahina, Journ. Jap. Bot. 26: 259 (1951). Type: Japan, Prov. Musahshi, Tochimoto, Chichibu, July 27, 1933, *Asahina* (TNS, lectotype). *Punctelia borreri* (Sm.) Krog. Nord. J. Bot. 2: 291 (1982).

Thallus foliose, rosette-forming, adnate, usually 3–6 cm diam., grey to bluish grey; lobes flat to concave, broad, 3–5 mm, contiguous to slightly overlapping, closely

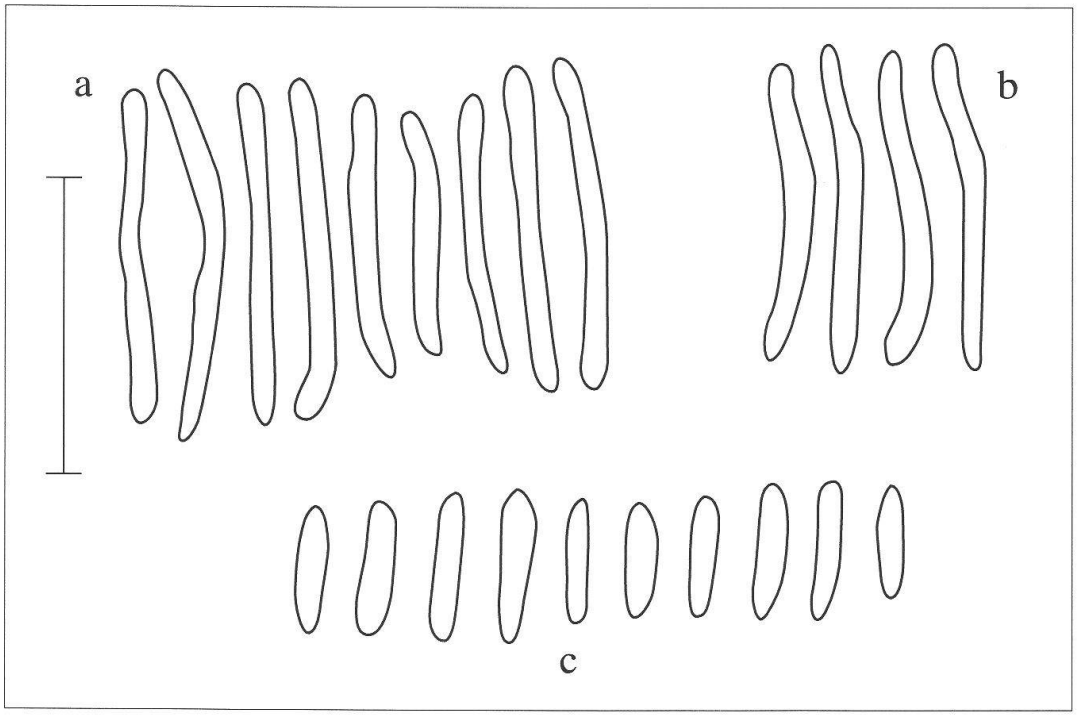

Fig. 1. *Parmelia stictica* (a: *Frey 30077* [G]; b: Isotype [G]) and *Parmelia borreri* (c: *Frey 24979* [G]): pycnoconidia (scale bar = 10 μm).

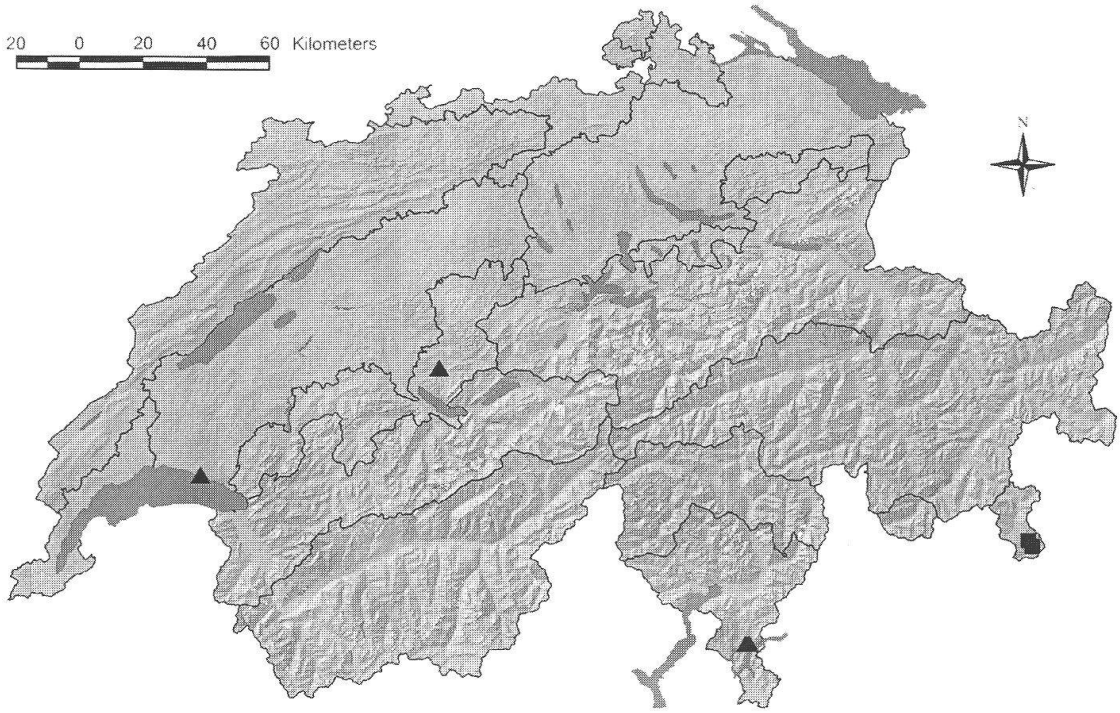

Fig. 2. *Parmelia borreri* (triangles) and *Parmelia stictica* (squares): known distribution in Switzerland.

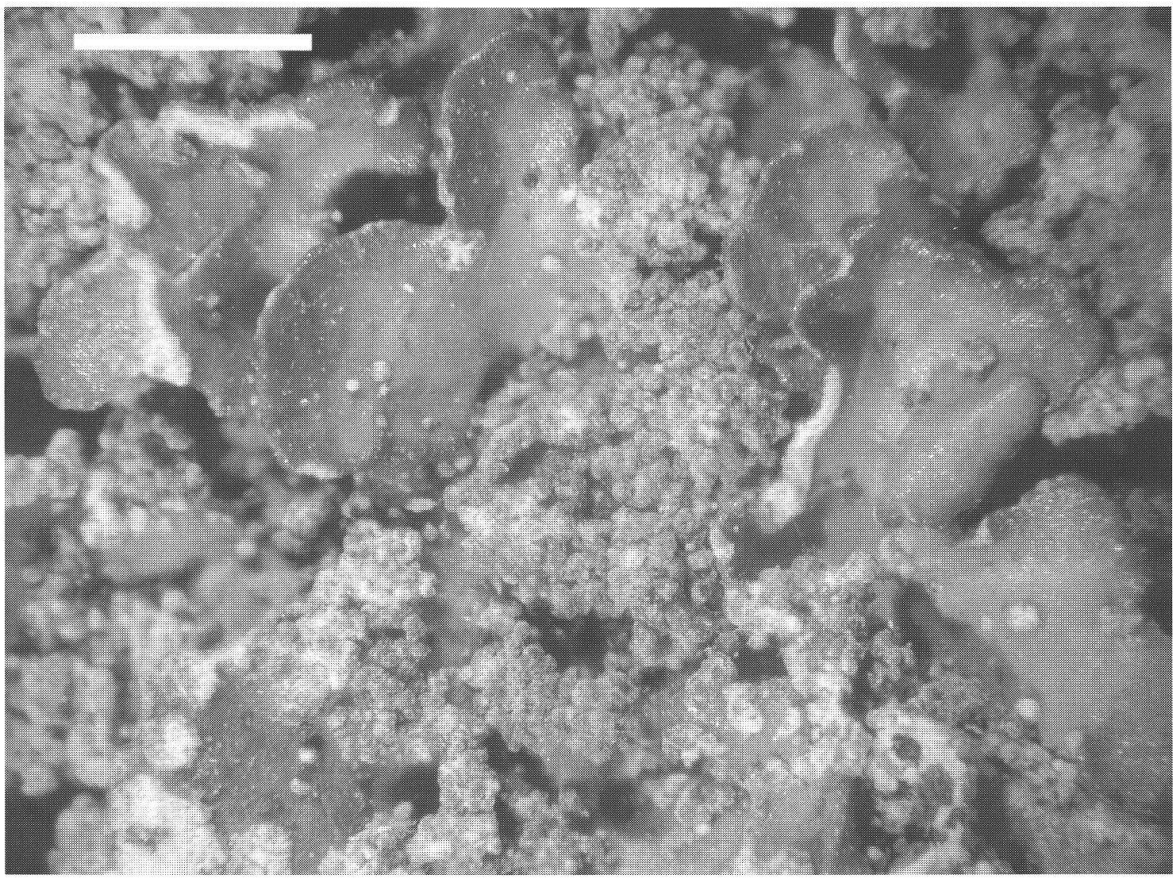

Fig. 3. *Parmelia stictica* (Isotype [G]): isidia-like soredia, overlapping, short and narrow lobes (scale bar = 1 mm).

adpressed, mat and sometimes distinctly pruinose; lower surface brownish black or at least darkening toward the centre of the thallus; soralia dot-like, whitish, generally distinctly rounded (Fig. 7), arising from scattered small punctiform, rarely linear or sigmoid pseudocyphellae, often confluent with age; soredia farinose to subgranular on older thalli; apothecia not seen; pycnoconidia bacilliform to slightly bifusiform (Fig. 1), (4) 4.5–**5**–5.5 (6) μm long (n = 10, one specimen measured).

Chemistry: Gyrophoric acid (medulla C+ rose), sometimes lecanoric acid, atranorin (cortex K+ yellow).

Ecology: Corticolous, rarely saxicolous (not found so far on this substrate in Switzerland). In Switzerland, it has been found on *Malus* spp. and *Tilia* spp. in localities with high atmospheric humidity.

Distribution: Africa (Krog and Swinscow 1977), Asia (Culberson 1960), Europe, North America (Brodo et al. 2001), Oceania (Elix 1994), South America (Krog and Swinscow 1977).

In western and southern Europe where it seems to be widespread (Hale 1965, Seaward and Hitch 1982) *Parmelia borreri* has a strongly oceanic distribution with scattered occurences in the central part of Europe, north and south of the Alps, south Germany where it is very rare (Wirth 1995), Italy (Nimis 1993) and Switzerland (Fig. 2).

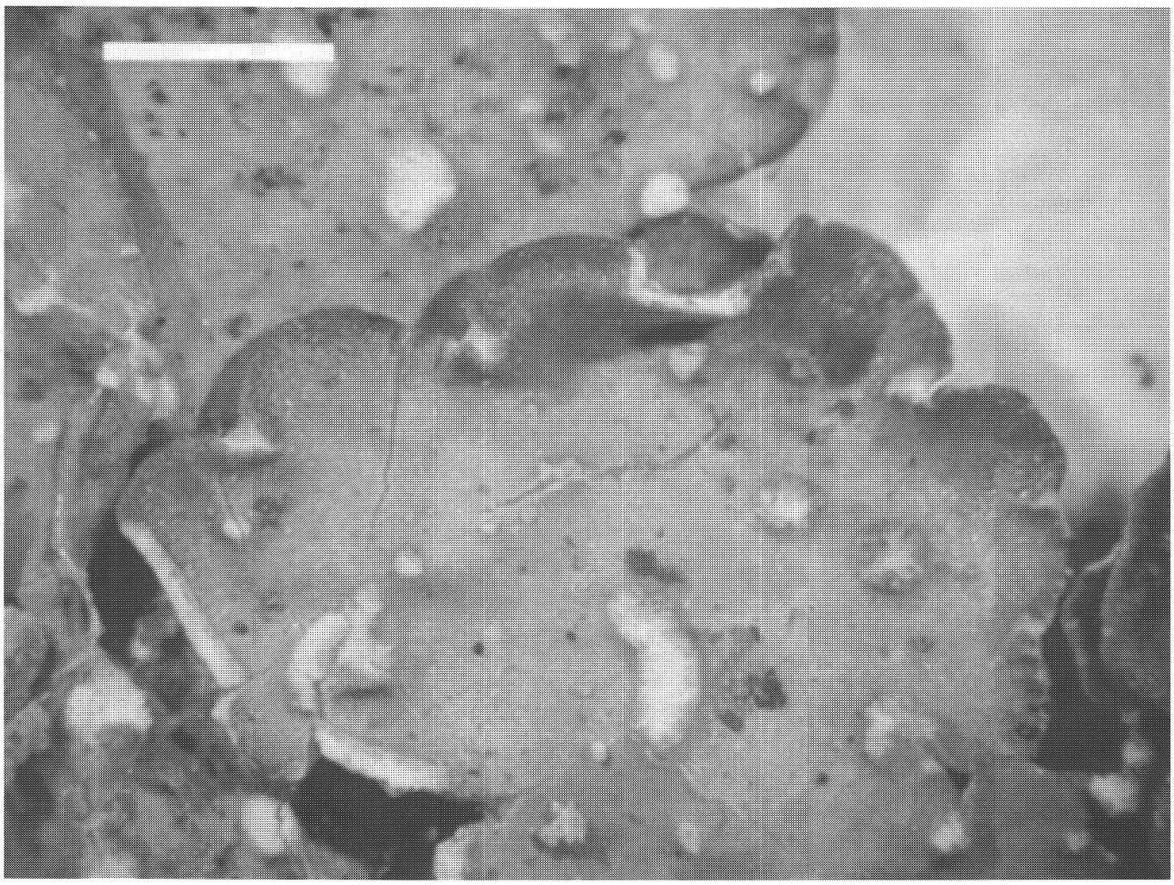

Fig. 4. *Parmelia stictica* (Isotype [G]): margin of lobe with soralia and dark brownish tinge (scale bar = 1 mm).

Specimens studied

BERN, Schwarzenegg, 621.100 × 182.700, 920 m, *P. Clerc* 445803 (G); TESSIN, Lugano, 717.000 × 96.000, 300 m, 1919, *Mereschkowski* (Z); TESSIN, Lugano, 718.000 × 96.000, 275 m, allée d'arbre bordant le canal, sur *Tilia*, 30.v.1962, *E. Frey* 24979 (G); VAUD, Cully, 546.000 × 149.000, 380 m, dans un parc, sur *Malus*, 1.vi.1999, *I. Roth* 15897 (G).

Discussion

Recently, Longan et al. (2000) discussed the value of the color of the lower surface as a criteria for separating *P. borreri* from *P. subrudecta*. All specimens with gyrophoric acid collected in Switzerland are consistently black towards the center of the thallus and thus we agree with Longan et al. (2000) that what really matters is the colour gradient from the periphery to the center of the thallus. For the distinction with *P. stictica*, see discussion under this species.

Parmelia borreri seems to be a rare lichen in Switzerland (Fig. 2). Spier and Herk (1997) documented a recent increase of *P. borreri* in the Netherlands. Unfortunately we were not able to evaluate whether the same process is happening in Switerland since *P. borreri* was not separated from *P. subrudecta* in the recent corticolous relevés made in the framework of the Red Data List project (Scheidegger et al. 2002). It was rarely

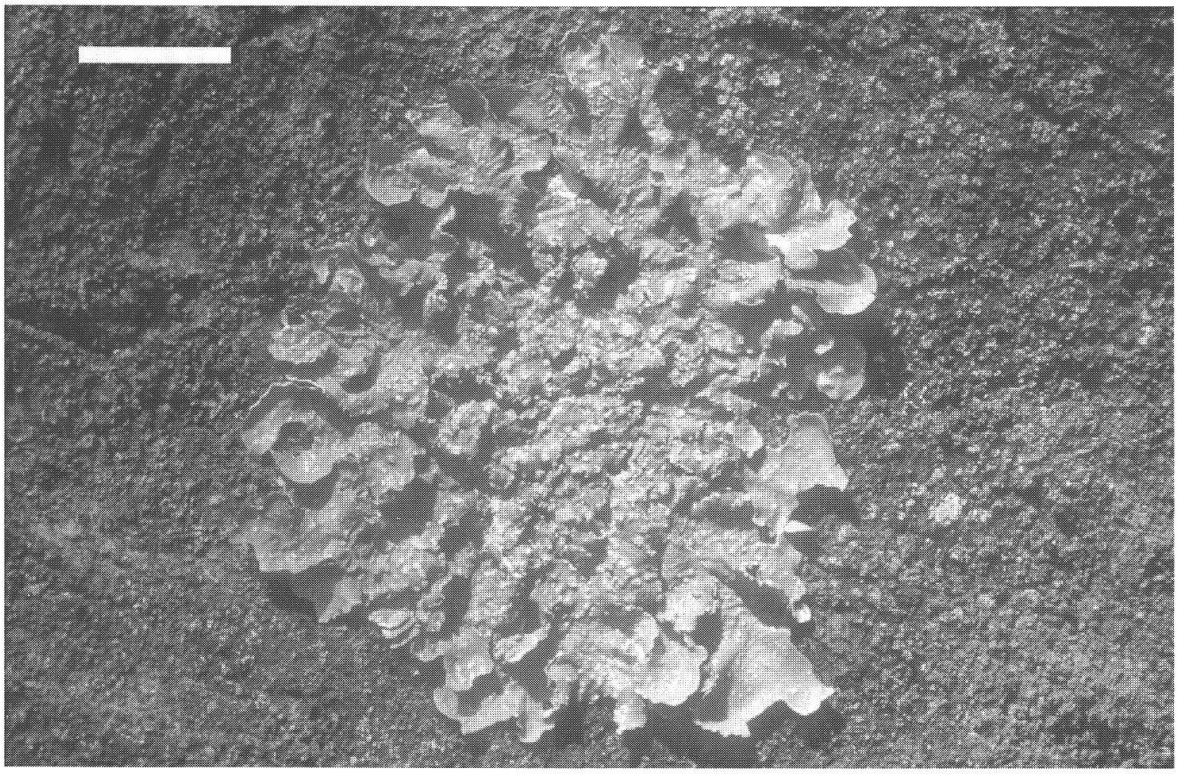

Fig. 5. *Parmelia subrudecta* (CJB, *Acer palmatum*, 2002, P. *Clerc & C. Truong*): thallus (scale bar = 1 cm).

collected since *P. subrudecta* aggr. was considered as a frequent and well-known species in this project.

***Parmelia stictica* (Duby) Nyl.** Bull. Soc. Linn. Normand., Sér. 2, 6:270 (1872). *Parmelia borreri* β *stictica* Duby, Bot. Gall. 2: 601 (1830). Type: Vire, Delise [H-Nyl 35043, isotype; G, isotype (!): pycnoconidia (9.5) 10.5–12.5–14.5 μm long (n = 5)]. *Punctelia stictica* (Duby) Krog. Nord. J. Bot. 2: 291 (1982). *Parmelia dubia* auct. pro parte.

Thallus foliose, to 6 cm, forming irregular patches; lobes flat to concave, short and narrow, 1–2 (–3) mm broad, slightly raised at their extremities, markedly crowded and overlapping (Fig. 3), brownish grey to brown, with a distinct dark brownish tinge towards the margins (Fig. 4); lower surface brownish black or at least darkening toward the centre of the thallus; soralia mainly laminal but often marginal as well, rounded, arising from punctiform pseudocyphellae, often confluent (Fig. 4); soredia farinose and whitish to very coarse and brown, approaching isidia-like structures in older part of thallus (Fig. 3); apothecia not seen; pycnoconidia filiform to unciform (Fig. 1), (9) 10.5–**12.5**–14.5 (15) μm long (n = 10, one specimen measured).

Chemistry: Gyrophoric acid (medulla C+ pink), atranorin (cortex K+ yellow).

Ecology: Saxicolous on acid rocks (gneis). In Switzerland it occurs on siliceous rocks (gneis) covered with mosses and other lichens (*Parmelia crinita*, *P. revoluta*, *P. saxatilis*, etc.).

Distribution: Africa (Krog and Swinscow 1977), Europe, North America (Brodo et al. 2001), South America (Adler 1996). In Europe, this species is largely confined to western France (Hale 1965). Krog (1970) reported several occurences in Oppland

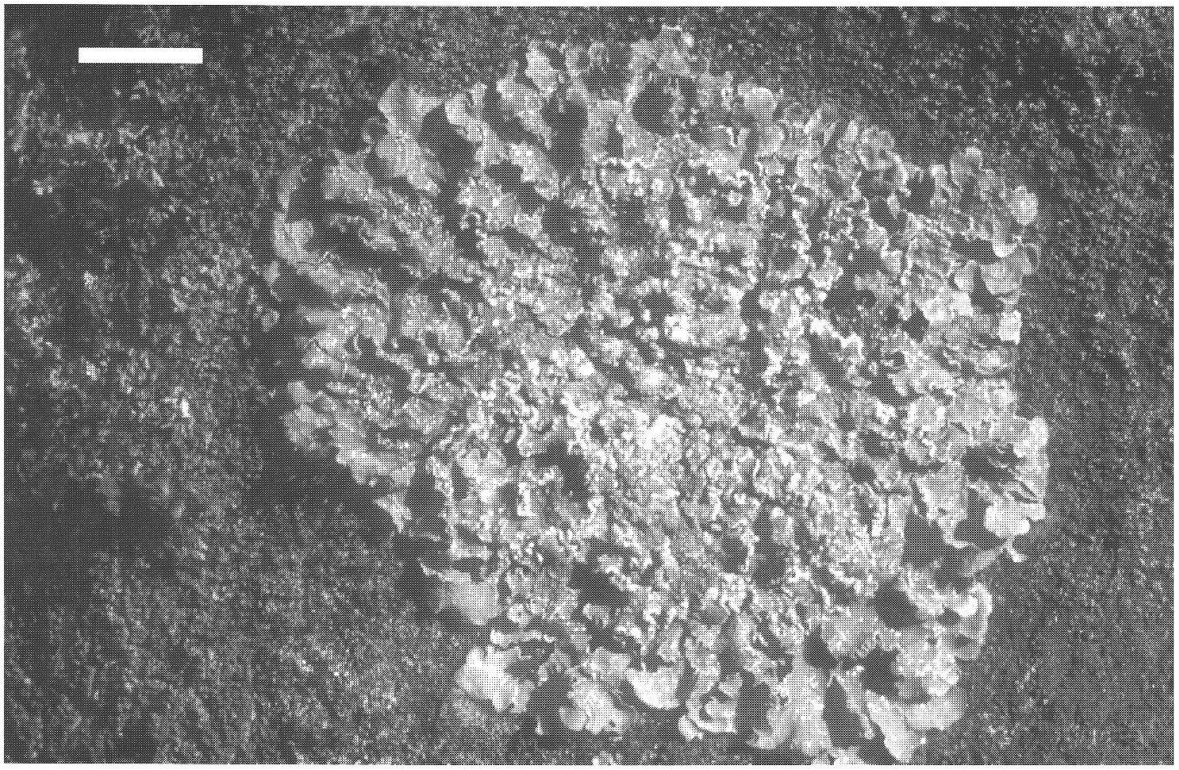

Fig. 6. *Parmelia ulophylla* (CJB, *Acer palmatum*, 2002, *P. Clerc & C. Truong*): thallus (scale bar = 1 cm).

county (Norway) although these records need to be checked against *P. borreri*, since no information on the pycnoconidia was given. Poelt (1957) was the first to report the presence of *P. stictica* in central Europe, based on a specimen collected in Switzerland (Brusio). Its occurence in Italy remains to be confirmed (Nimis 1993).

In Switzerland (Fig. 2), this species has been so far found only in the south eastern part of the country (Grisons; Poelt 1957, Frey 1959).

Specimens studied

GRISONS, Brusio, Poschiavo, 807.000 × 126.500, 800 m, station ombragée près de la voie ferrée, sur gneiss, 10.vi.1957, *J. Poelt* 30077 (G); GRISONS, Motta, Lago di Poschiavo, 805.800 × 128.300, 1150 m, éboulis de gros blocs, sur gneiss moussus, 11.viii.1958, *E. Frey* 20962 (G);

Discussion

Parmelia stictica seems to be quite morphologically variable. Specimens from western France, where the type material belongs, and specimens collected in Switzerland share the same general habit: a brownish thallus forming irregular patches with narrow lobes that are loosely attached, markedly crowded and overlapping. Specimens from East Africa (Krog and Swinscow 1977), North America (Brodo et al. 2001: Fig. 738) and South America (Adler 1996) look much more like *Parmelia borreri* with rosette-forming greyish thalli and larger lobes that are ± contiguous and ± closely adpressed. These two different morphotypes are held together by the presence of gyrophoric acid in the medulla, the black underside and the length of their pycnoconidia. Further detailed

taxonomical studies are needed to evaluate whether the African and American specimens can be separated from *P. stictica* s.str. (european specimens).

The only consistent characters separating *P. stictica* from *P. borreri* are the ecology (*P. stictica* is a strictly saxicolous species in Europe) and the length of the pycnoconidia (Fig. 1). Other characters mentioned in the literature like the brownish marginal tinge and the isidia-like development of the soredia in *P. stictica* (Figs. 3 and 4) might well be triggered by environmental factors encountered in the saxicolous habitat like for example strong exposure to the sun (Adler 1996). Furthermore, isidia-like development of soredia is not rare in *P. subrudecta*, at least in specimens collected in Switzerland and the brownish tinge may be present to some extent in all species of this group.

***Parmelia subrudecta* Nyl.** Flora 69: 320 (1886). Type: Ile St. Paul (H-Nyl 35033, holotype). *Punctelia subrudecta* (Nyl.) Krog. Nord. J. Bot. 2: 291 (1982). *Parmelia dubia* auct. pro parte.

Thallus foliose, usually rosette-forming, 2-6 cm diam. (Fig. 5), adnate; lobes flat to concave, 0.5–5 mm wide, contiguous to slightly overlapping, somewhat downcurved and frequently browned along the margins, secondary lobes, when present, indistinguishable from the marginal lobes; upper surface mineral grey, turning slowly greenish when wetted, with occasionally browned and always shiny margins, without pruina; lower surface homogeneously pale brown or margins dark brown but lighter towards the center of the thallus; soralia mainly laminal, rounded, arising from punctiform pseudocyphellae, often confluent with age (Fig. 8); marginal soralia also often present, mainly at the incision of secondary lobes in mature thalli; soredia farinose to very coarse, isidia-like especially on older thalli; apothecia not seen; pycnoconidia not seen.

Chemistry: Lecanoric acid (medulla C+ red), atranorin (cortex K+ yellow).

Ecology: Corticolous, very rarely saxicolous. In Switzerland, *Parmelia subrudecta* grows on a wide variety of trees, with some preference for *Quercus*, *Fagus*, *Tilia* and fruit-trees. In the south of the Alps (Tessin), this species is frequently found growing on *Juglans* and *Castanea*. It occurs mostly on isolated trees along roads and rivers or at the edge and inside low dense forest. It grows sometimes side by side with *Parmelia ulophylla*, often together with *P. sulcata*, *P. revoluta* and other corticolous *Parmelia* spp., as well as *Hypogymnia physodes* and *Physcia* spp.

Distribution: Africa (Krog and Swinscow 1977), Asia (Adler and Ahti 1996), Europe, North America (Brodo et al. 2001), Oceania (Elix 1994). Widespread and cosmopolitan. In Switzerland (Fig. 11) this species is widespread and frequent except in the central Alps (Valais and Grisons), where no specimen has been found at all in this investigation and where it is probably too dry for this taxon. It is a common species at low altitudinal range (700 m and less). *Parmelia subrudecta* is especially abundant south of the Alps (Tessin) (Fig. 11), where it seems to be more frequent than *P. ulophylla.*

Selection of specimens studied

AARGAU, südlich Lenzburg, 500 m, Schwarzerlen [*Alnus incana*] am Stadtbächli, 9.ix.1961, *E. Frey* 24416 (G); BERN, Brienz, Brienzerberg, Frutt, 780 m, clairière pâturée, sur *Fagus sylvatica*, 25.iv.1982, *P. Clerc* (G); GENÈVE, Cartigny, Moulin-de-Vert, Pré nord, 350 m, sur les branches d'un buisson, 22.iv.2002, *C. Truong & P. Clerc* (G); GRAUBÜNDEN, Puschlav, Westufer des Lago di Poschiavo, 1000 m, lichter Lärchenwald, auf *Larix decidua*, 8.viii.1958, *E. Frey* 22139 (G); LUCERNE, Eigental, Chrienser Howald, Würzen, 1035 m, allée de *Fraxinus* au bord du chemin, sur *Fraxinus excelsior*,

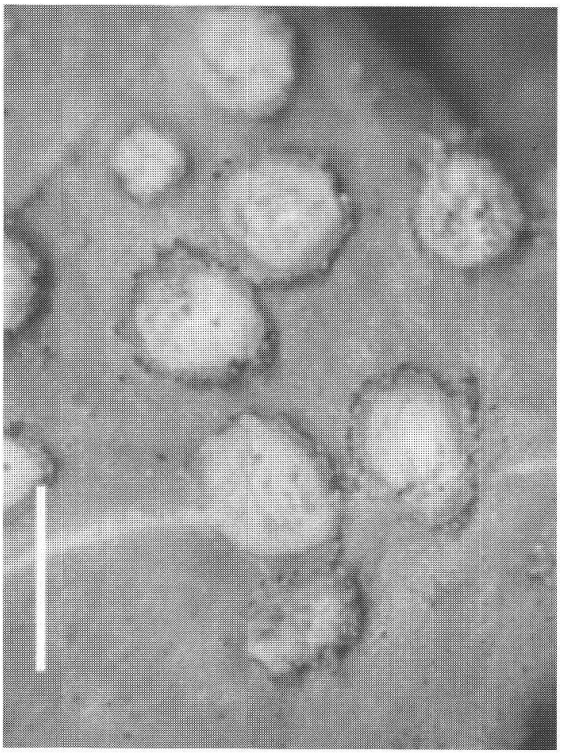

Fig. 7. *Parmelia borreri* (Lugano, 1919, *Mereschkowski* [Z]): soralia (scale bar = 1 mm).

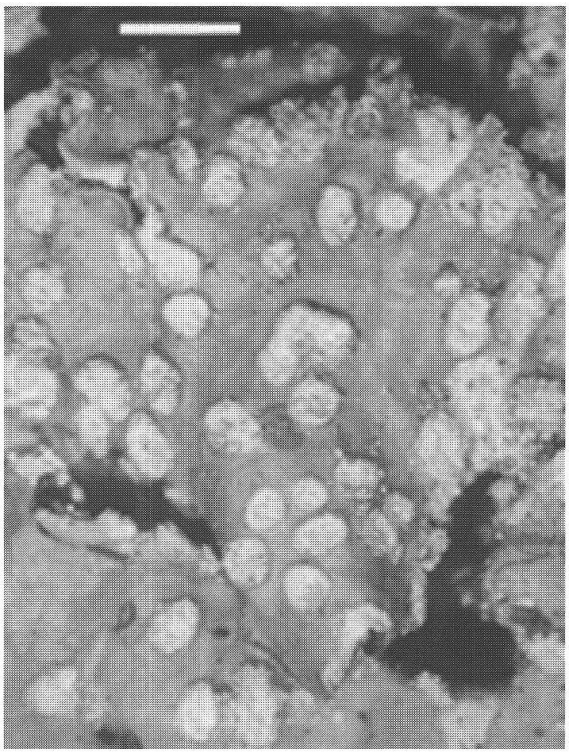

Fig. 8. *Parmelia subrudecta* (*Frey 23524* [G]): soralia (scale bar = 1 mm)

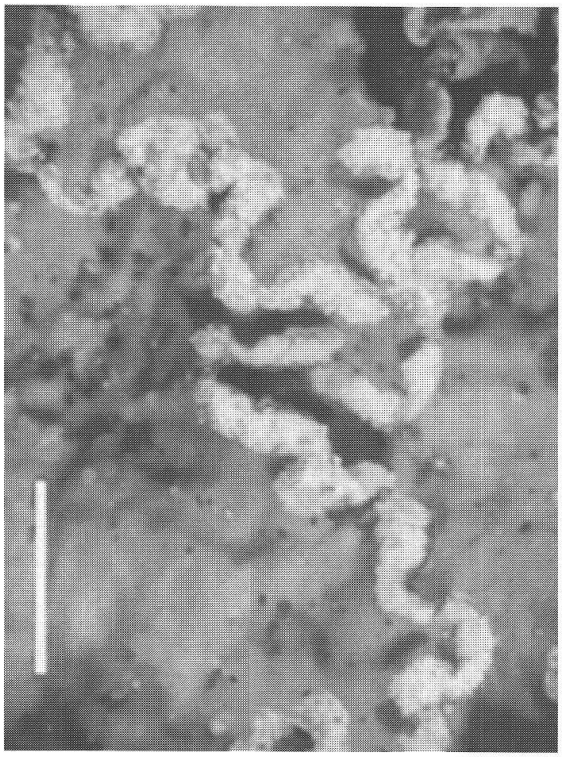

Fig. 9. *Parmelia ulophylla* (Maschwanden, 02.1883 [Z]): soralia (scale bar = 1 mm).

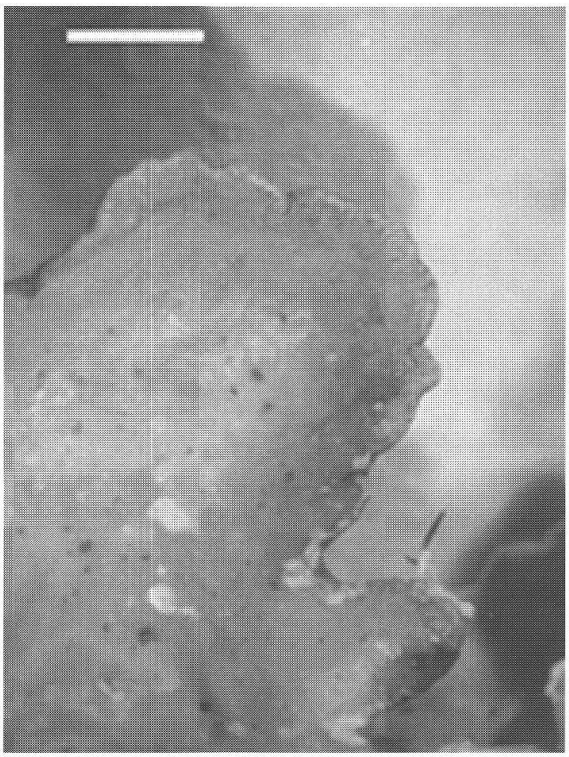

Fig. 10. *Parmelia ulophylla* (Aïre, *Malus*, *Rome* [G]): lobe margin with pruina (scale bar = 1 mm).

6.v.1983, *P. Clerc* 83/153 (G); NEUCHÂTEL, port de Hauterive, 430 m, dans un parc, sur *Tilia*, 11.v.2002. *C. Truong & N. Margraf* (G); SCHWYZ, Einsiedeln, südöstl. des Klosters, 1050 m, auf Buchen und Weisstannen, 11.viii.1932, *E. Frey* 11220 (G); TESSIN, Centovalli, über Borgnone, 900 m, Balm unter grossen Gneisblöcken, 23.vii.1927, *E. Frey* 1841 (G); ZÜRICH, Neeracher Riedt zwischen Niederglatt und Neerach, 412 m, alte Linden [*Tilia* spp.] auf dem Lindenbuck, 6.vii.1957, *E. Frey* 19816 (G).

Discussion

see under *P. ulophylla*.

***Parmelia ulophylla* (Ach.) Wilson** Pap. Proc. R. Soc. Tasm. 1872: 172 (1893). *Parmelia caperata* var. *ulophylla* Ach., Lichenogr. Univ.: 458 (1810). Type: Switzerland, *Schleicher* (H-Ach. 1338, left-hand specimen, lectotype). *Parmelia borreri* var. *ulophylla* (Ach.) Nyl, *Punctelia ulophylla* (Ach.) van Herk & Aproot. Lichenologist 32: 239 (2000). *Parmelia dubia* auct. pro parte. *Parmelia subrudecta* auct. pro parte.

Thallus foliose, usually rosette-forming, 2–6 cm diam., adnate (Fig. 6); lobes flat to concave, 0.5–5 mm wide, somewhat upcurved and contorted along the margin; secondary lobes when present markedly different from the marginal lobes, the first being smaller and distinctly sorediate along the margins; upper surface mineral grey, turning quickly and distinctly green when wetted, mat and usually pruinose (Fig. 10) at the extremities (not all lobes however); lower surface creamy white to light brown, if darker at the margins then lighter towards the center of the thallus; soralia mainly marginal along secondary lobes (Fig. 9), whitish; laminal soralia often also present, punctiform to rounded on older thalli; soredia farinose to granular; apothecia not seen, pycnoconidia not seen.

Chemistry: Lecanoric acid (medulla C+ red), atranorin (cortex K+ yellow).

Ecology: Corticolous on a wide variety of trees with some preferences for *Quercus*, *Acer*, *Tilia*, fruit-trees and some gymnosperms like *Pinus* and *Abies*. Common in semi-urban areas on isolated trees along roads, in parks and orchards, *Parmelia ulophylla* is also found at the edge of and inside low-dense forest. It often shares its habitat with *P. subrudecta* and other *Parmelia* species, with some predilection for *P. sulcata* and *P. tiliacea*.

Distribution: Probably the same distribution as *P. subrudecta* but published so far only for Europe (Herk and Aptroot 2000) and Oceania (Elix 1994). In Switzerland (Fig. 12) *Parmelia ulophylla* is very common north of the Alps, where it seems to be more frequent than *P. subrudecta*. It is almost absent in the central Alps, and this species also seems to be rare south of the Alps (Tessin). Usually found at altitudes between 400 and 600 m, but it can reach up to 1000 m altitude.

Selection of specimens studied

AARGAU, Lenzburg, Schützenmatte, 415 m, Alleebäume, alte Linden, Rosskastanien, 8.x.1961, *E. Frey* 24453 (G); BASELLAND, am Binnbach nördlich Witterswil, 345 m, auf *Juglans*, 21.ix.1962, *E. Frey* 25340 (G); BERN, Mittelland, Amt Konolfingen, Hohwald-Toppwald, 1115 m, *Abies* auf dem Bergkamm, 20.x.1955, *E. Frey* 19491 (G); GENÈVE, ville de Genève, parc des Bastions, 380 m, sur *Aesculus* spp., 20.i.1995, *P. Clerc* (G); GRAUBÜNDEN, Tardisbrücke bei Landquart, *Pinus sylvestris* Bestand, auf *Pinus sylvestris*, 6.viii.1955, *E. Frey* 17981 (G); LUZERN, Entlebuch, an der Strasse von Schachen zur Rengg, 860 m, Bergahorn und Ebereschen, 15.v.1957, *E. Frey* 19760 (G);

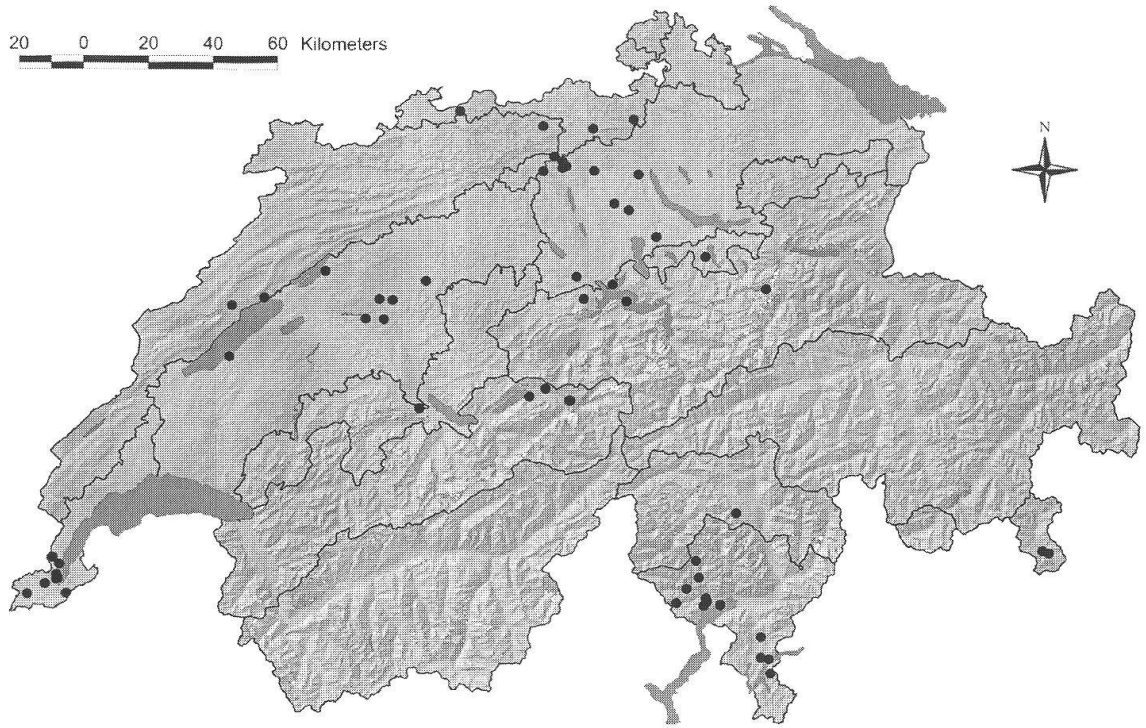

Fig. 11. *Parmelia subrudecta*: known distribution in Switzerland.

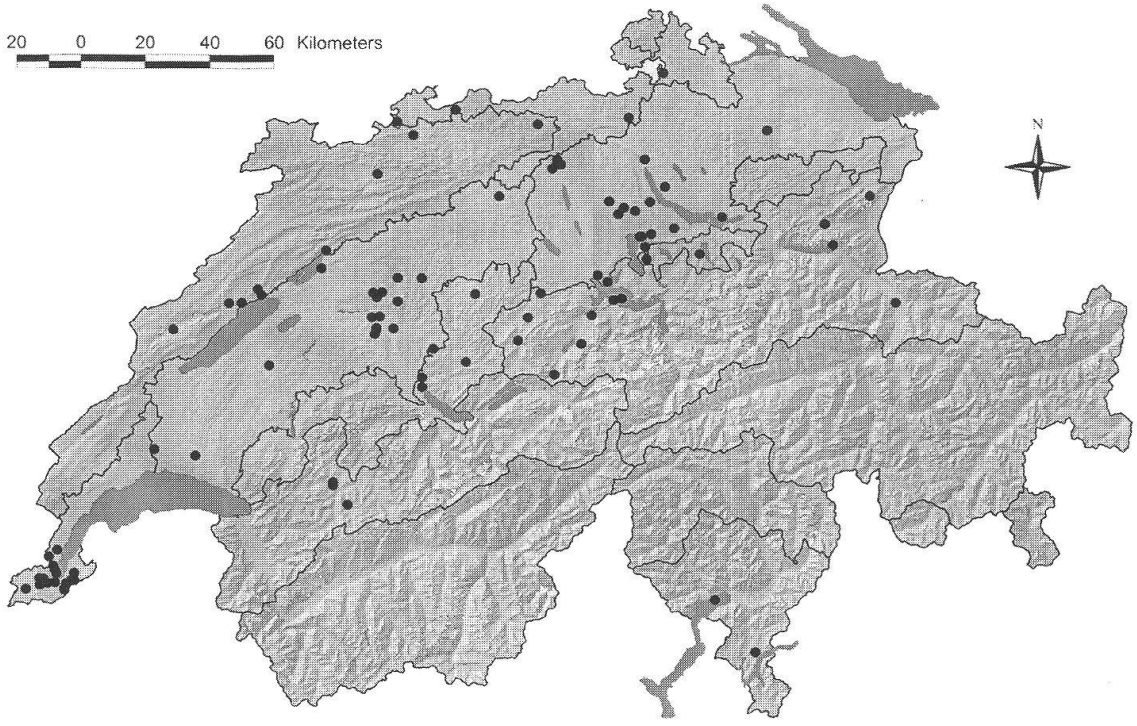

Fig. 12. *Parmelia ulophylla*: known distribution in Switzerland.

NEUCHÂTEL, Peseux, 545 m, dans un verger, sur *Malus*, 11.05.2002, *C. Truong* (G); VAUD, Grand bois du Grand Jorat, Auenwald am rivière de Pierre Ozaires, 820 m, *Alnus glutinosa* und *Fraxinus*, 19.vii.1962, *E. Frey* 25254 (G); ZÜRICH, Hoheberg bei Schönenberg, 685 m, Eschen und Eichen in Galeriewäldchen an kleinem Bach, 24.viii.1962, *E. Frey* 25567 (G).

Discussion

We were able to confirm the very strong correlation between the position of the soralia – mainly marginal versus mainly laminal – and the presence and absence, respectively, of pruina on the margins, as shown by Herk and Aptroot (2000). Intermediates seem to be very rare. On this basis (Clerc 1998), we agree with Herk and Aptroot (2000) and consider *P. ulophylla* and *P. subrudecta* to be two well delimited species. Problematic specimens consisting of too old or too young thalli or incomplete or badly developed thalli where diagnostic characters are not well developed or absent are difficult to identify. In these cases, it is often difficult to see, for instance, whether the pruina is present or not. Moreover, the abundance of pruina might depend on enviromental factors such as the content of $CaCO_3$ in the substrate and thus be quite variable from one specimen to another in *P. ulophylla*. In the same way, the margin of *P. subrudecta* sometimes appears a bit farinose, probably due to mineral deposits, that can extend to the entire thallus.

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Résumé

La morphologie, la chimie, l'anatomie, ainsi que la distribution et l'écologie de *Parmelia borreri*, *P. stictica*, *P. subrudecta* et *P. ulophylla* en Suisse sont discutées. Une clé de détermination, ainsi que pour chacune de ces espèces, des cartes de distributions pour la Suisse, sont présentées. La validité de *P. ulophylla* en tant que bonne espèce par rapport à *P. subrudecta* est confirmée. Les différences (écologie et longeur des pycnidiospores) entre *P. stictica* et *P. borreri* sont mises en évidence.

Zuammenfassung

Die Morphologie, Chemie, Anatomie wie auch die Verbreitung und Ökologie von *Parmelia borreri*, *P. stictica*, *P. subrudecta* und *P. ulophylla* in der Schweiz werden diskutiert. Ein Bestimmungsschlüssel und eine Verbreitungskarte für jede dieser Arten werden vorgestellt. Die Gültigkeit der *P. ulophylla* als eine gute Art in bezug auf *P. subrudecta* wird bestätigt. Die Unterschiede (Ökologie, Länge der Pyknidiosporen) zwischen *P. stictica* und *P. borreri* werden hervorgehoben.

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