

ON THE IDENTITY OF *LETHARIELLA SINENSIS* WEI & JIANG, WITH NEW REPORTS OF TIBETAN *LETHARIELLA* SPECIES*

WALTER OBERMAYER

Institut für Botanik, Karl-Franzens-Universität Graz, Holteigasse 6, A-8010 Graz, Austria

Abstract: The holotype material of *Lethariella sinensis* Wei & Jiang is a mixture of two chemically distinct taxa, one containing psoromic acid, the other containing norstictic acid. The former is chosen as lectotype and, as a result, *L. mieheana* Obermayer becomes a synonym of *L. sinensis*. Some further *Lethariella* specimens from Tibet have been subjected to TLC-analyses, and the results are presented.

Introduction

Species of *Lethariella* (Motyka) Krog subgenus *Chlorea* (Parmeliaceae) are mainly characterized by the orange colour (due to the lichen compound canarione), the presence of atranorin in the cortex and a pendulous, prostrate or shrubby thallus with a more or less solid central axis (like in *Usnea*). They are known from temperate Asia and Macaronesia and grow on sunny, exposed sites on bark and dead wood of conifers and, above the timber line, on soil (rarely on rocks). *Lethariella* is of ethnobotanical interest, with several ethnic groups in Pakistan (HUNECK 1991; HUNECK & FREMBGEN 1989), Tibet, Nepal and Bhutan using a glowing, smoking mixture of *Lethariella* thalli and *Juniperus* branches for sensual excitation at religious ceremonies (WEI *et al.* 1982; SUN *et al.* 1990).

OBERMAYER (1997) accepted eight species in subgenus *Chlorea* partly based on chemical characters (see Table 1). However, the identity of one species, *L. sinensis* Wei & Jiang, remained uncertain. According to the original description (WEI & JIANG 1982), this species produced an unknown lichen substance, but unfortunately the type material was unavailable for study by OBERMAYER (1997). Now, through the courtesy and efforts of Prof. Dr. J.-C. Wei, the holotype of *L. sinensis* (in HMAS) has been made available, and the results of its study and their nomenclatural implications are reported below.

The Species

Additional Tibetan localities of *Lethariella* species are given below (see also OBERMAYER 1996: 8, Fig. 1; 1997: 63, Fig. 2.3 and 64, Fig. 4), as well as TLC data of the specimens cited.

* Lichenological results of the Sino-German Joint Expedition to south-eastern and eastern Tibet 1994. V.

***Lethariella cashmeriana* Krog**

TLC: Atranorin, canarione, gyrophoric acid, norstictic acid (minor)

Specimens examined: —CHINA. *E Tibet*: Xizang, Upper Mekong basin, Mekong–Zi Qu divide, pass W of Quamdo, 31°05'N, 96°58'E, alt. 4550 m, epiphytic in exposed, open *Juniperus* forest, 19.ix.1994, G. & S. Miehe & U. Wündisch 94-347-2A (GZU; richly fertile); *loc. id.*, G. & S. Miehe & U. Wündisch 94-347-2C (GOET).

***Lethariella cladonioides* (Nyl.) Krog**

TLC: Atranorin, canarione, psoromic acid, 2'-*O*-demethylpsoromic acid.

Specimens examined: —CHINA. *S Tibet*: Xizang, Tibetan Himalaya, E of Mt Everest, Kama Chu, W of Sakyatang (Camp Ev3-4), 27°58'N, 87°13'E, alt. 4290 m alt., subalpine tree-line (*Juniperus-Rhododendron* forest), SE facing gneiss slope, on *Juniperus* sp., 14.x.1989, B. Dickoré K-80-2b (GZU); *loc. id.*, B. Dickoré K-80-10 (GZU). *SE Tibet (Xizang)*: Tsangpo tributary, Nangxian to Mainling, Lilung Chu Eastern branch (High Camp), 29°3'N, 93°57'E, alt. 4440 m, on *Juniperus* 3–6 m tall, partly multi-stemmed on S-facing slope, 2.viii.1994, G. Miehe & U. Wündisch 94-171-2B (GZU).

***Lethariella flexuosa* (Nyl.) Wei**

TLC: atranorin, canarione, psoromic acid, 2'-*O*-demthylpsoromic acid.

Specimen examined: —CHINA. *S-Tibet (Xizang)*: Tibetan Himalaya, E of Mt Everest, head of Kangchung Glacier, 13 km E of Mt Everest summit (Camp Ev8), 28°59'N, 87°02'E, alt. 5280 m, upper alpine *Kobresia pygmaea* turf, cushions, on open windblown moraine shoulder, on the ground, 16.x.1989, B. Dickoré K-60-1 (GZU).

***Lethariella sernanderi* (Motyka) Obermayer**

TLC: Atranorin, canarione, norstictic acid.

Note: This specimen, on soil, closely resembles epiphytic *L. sernanderi* (including soralia).

Specimens examined: —CHINA. *SE Tibet (Xizang)*: upper Yi'ong Zangbo, near Lhari, above Tschama Yumco, 30°38'N, 93°12'E, alt. 4780 m, relict Juniperous-Sabina forest on steep S-facing slope, on *Juniperus*, 3.ix.1995, G. & S. Miehe 95-08-47A (GZU). *S Tibet (Xizang)*: Tibetan Himalaya, E of Mt Everest, head Kangchung Glacier, 13 km E of Mt Everest summit (Camp Ev8), 28°59'N, 87°02'E, alt. 5280 m alt., upper alpine *Kobresia pygmaea* turf, cushions, on open wind-blown moraine shoulder, on the ground, 16.x.1989, B. Dickoré K-60-2 (GZU).

***Lethariella sinensis* Wei & Jiang**

Acta Phytotax. Sin. 20(4): 498 (1982).

Typus. [CHINA. *Tibet*: Xizang,] Qamdo, alt. 4300 m, 2.vii.1976, *Li-Wen-hua* 76-95-(1) [Lectotype (selected here)—HMAS-L! (separated material; TLC: atranorin, canarione, psoromic acid, 2'-*O*-demethylpsoromic acid, traces of gyrophoric acid).

Table 1: Taxonomic concepts in *Lethariella* subgenus *Chlorea*. Solid lines separate morphologically and/or chemically well-defined taxa; broken lines separate taxa that are very closely related or, possibly, conspecific.

<i>Lethariella</i> subg. <i>Chlorea</i> sensu OBERMAYER (1997) (* the identity of <i>L. sinensis</i> was not clear)	Description and new combination	Current concept	Chemistry: (atranorin & canarione always present; fatty acids may occur)					soralia may occur	Habit	Substrate	<i>Lethariella</i> subg. <i>Chlorea</i> sensu KROG 1976
			placodioc acid	psoromic & 2'Oemethyl- psoromic acid	norstictic acid	gyrophoric acid					
<i>L. canariensis</i> (Ach.) Krog	(1810) 1976	<i>canariensis</i>	–	–	–	–	–	pendulous	bark/wood/rocks	<i>canariensis</i>	
<i>L. zahlbruckneri</i> (Du Rietz) Krog	(1926) 1976	<i>zahlbruckneri</i>	–	–	+	(+)/tr.	–	pendulous	bark/wood	<i>zahlbruckneri</i> (incl. <i>L. smithii</i>)	
<i>L. smithii</i> (DuRietz) Obermayer	(1926) 1997	<i>smithii</i>	+	–	–	–	–	pendulous/ prostrate	bark/wood/soil		
* <i>L. sinensis</i> Wei & Jiang	1982	<i>sinensis</i>	–	+	–	–	–	pendulous	bark/wood	–	
<i>L. mieheana</i> Obermayer	1997		–	–	–	–	–	pendulous	bark/wood	–	
<i>L. flexuosa</i> (Nyl.) Wei	(1860) 1982	<i>flexuosa</i>	–	+	–	–	–	prostrate	soil	<i>cladonioides</i> (incl. <i>L. flexuosa</i> , <i>L. sernanderi</i>)	
<i>L. cladonioides</i> (Nyl.) Krog	(1860) 1976	<i>cladonioides</i>	–	+	–	–	+	erect	soil?/wood		
<i>L. sernanderi</i> Motyka (<i>nom. nov.</i> for <i>Usnea reticulata</i> Du Rietz)	1936	<i>sernanderi</i>	–	–	+	–/(+)/ tr.	+	erect	bark/wood/soil/ rock	<i>L. cashmeriana</i>	
<i>L. cashmeriana</i> Krog	1976	<i>cashmeriana</i>	–	–	–/(+)/ +	+	+	erect	bark/wo		

Lethariella mieheana Obermayer, *Biblioth. Lichenol.* **68**: 56 (1997).

Typus. CHINA. *Tibet (Xizang)*: 350 km E of Lhasa, 20 km NE of Nyingchi, 5 km E of the pass, near the timber line, *Juniperus-Abies* forest, 29°38'N, 94°42'E, alt. 4300 m, on *Juniperus*, 26.viii.1994, W. Obermayer 3415 [Holotype—GZU!; isotypes—distributed as *Lichenotheca Graecensis* no. 35 sub *Lethariella* cf. *sinensis*; see OBERMAYER 1995: 7).

TLC: Atranorin, canarione, psoromic acid, 2'-*O*-demethylpsoromic acid, gyrophoric acid (trace).

Notes: *Lethariella sinensis* was described from Tibet by WEI & JIANG (1982: 498) as an orange, long-pendulous lichen, with a rather reticulate surface. In the Latin diagnosis, the authors compared it with *L. zahlbruckneri*, from which it apparently differed in having a more reticulate rugose surface and in containing a different lichen substance. The name of the compound in *L. sinensis* was not specified, but the height of its spot (in TLC using solvent system A) was shown to run slightly slower than atranorin (WEI & JIANG 1982, Fig. 5). In comparison, the spot of the unknown substance of *L. zahlbruckneri* was shown with a somewhat lower RF-value than that in *L. sinensis*.

WEI & JIANG (1982) applied the taxon *L. zahlbruckneri* in a broad sense, and their concept of this species included *L. smithii* (Du Rietz) Obermayer. In fact, it was the type specimen of *L. smithii* which was used in their chemical studies. Subsequently, OBERMAYER (1997) established that the chemical compound in *L. smithii* is placodiolic acid. SUN *et al.* (1990) previously recorded this substance in *L. zahlbruckneri*, but again their concept of this taxon was very broad and included *L. smithii*. Indeed, *L. zahlbruckneri* in the strict sense of OBERMAYER (1997) actually contains norstictic acid.

While studying the lichen genus *Oropogon* (see OBERMAYER 1998), it became clear that the height at which placodiolic acid appears on the plate strongly depends on its concentration, an low concentrations appearing much lower on the plates. This is especially true in solvent system A and, to a lesser degree, in solvent system C. An almost identical response has been observed in the related substance usnic acid. It is, therefore, possible that the two apparently different unknown spots observed by WEI & JIANG in *L. sinensis* and *L. smithii* (see above) represent the same compound (placodiolic acid) at different concentrations. In this case, *L. sinensis* would have become a synonym of *L. smithii*. Furthermore, the development of more or less reticulate ridges on the surface, which was indicated in the protologue as an additional distinguishing feature, can vary greatly within the same taxon or even within the same thallus. This character is regarded as being of very low taxonomic value in this group, except in *L. canariensis* which has a consistently smooth surface.

TLC investigations have now been undertaken on the very richly developed holotype of *L. sinensis*. This specimen consists of many long, interwoven filaments, and is in fact a mixture of two distinct taxa: Almost all small pieces, taken from different thallus fragments, contain psoromic acid and 2'-*O*-demethylpsoromic acid as major compounds in addition to atranorin and canarione. This "chemotaxon" has been described recently as *L. mieheana* (OBERMAYER 1997). However, a few fragments contain norstictic acid, accompanied by small amounts of gyrophoric acid, and thus belong to *L.*

zahlbruckneri sens. str. (OBERMAYER 1997). None of the samples investigated contain any substance like placodiolic acid, suggesting that perhaps the specimen originally contained three chemically distinct taxa but that one has been used up in the course of previous TLC investigations. Thus it is highly probable that *L. sinensis* has been based on three discordant elements.

As a consequence, and in compliance with Articles 9.1, 9.2 and 9.10 of the *Code*, a lectotype is designated here. As no material with placodiolic acid has been found, and as most of the type contains psoromic acid as a major compound, this material is chosen as the lectotype, thus making *L. mieheana* a synonym of *L. sinensis*.

One possible solution to the taxonomic problems in this species complex would be to combine all pendulous, Central Asian *Lethariella* taxa into one species with three chemotypes. However, as discussed by OBERMAYER (1997), there are reasons to maintain these mostly sterile entities as separate taxa, especially since the mainly vegetative propagation leads to genetically quite uniform populations. Morphological features in *Lehtariella* (subgenus *Chlorea*) which might be influenced by substrata and result in variable growth form (especially 'prostrate' on the ground, as opposed to 'pendulous' on trees) remains to be discussed in more detail; see also notes under *L. cf. smithii* (below).

Additional specimens examined: —CHINA. *E Tibet*: Xizang, Upper Mekong basin, Mekong–Zi Qu divide, pass W of Quamdo, 31°05'N, 96°58'E, alt. 4550 m, epiphytic in exposed, open *Juniperus* forest, 19.ix.1994, G. & S. Miehe & U. Wündisch 94-347-2B (GZU); *loc. id.*, G. & S. Miehe & U. Wündisch 94-347-2AI (GZU); *loc. id.*, G. & S. Miehe & U. Wündisch 94-347-2D (GOET); *loc. id.*, alt. 4280 m., S-facing limestone cliff in *Picea* forest, 20.ix.1994, G. & S. Miehe & U. Wündisch 94-357-4a (GZU).

***Lethariella cf. smithii* (Du Rietz) Obermayer**

TLC: Atranorin, canarione, placodiolic acid.

Notes: The habit and morphology of these terricolous specimens resemble those of *L. flexuosa sens. lat.* (with mainly psoromic acid; see OBERMAYER 1997). However, no terricolous *Lethariella* taxon containing placodiolic acid has been described. Thus it is probable that prostrate, terricolous *Lethariella* specimens might be ecotypes of normally pendulous, corticolous taxa which, in moving from a corticolous to a terricolous habit, might develop stiffer, stouter and more richly branched thalli. This would necessitate *L. sinensis* becoming a synonym of *L. flexuosa*; however, more field-studies are necessary to resolve the taxonomy of these species.

Specimens examined: —CHINA. *Tibet*: Xizang, Upper Salween/Kyi Chu, Nagqu to Lhari, Kyu Chu-Nagqu watershed (pass), 31°04'N, 92°23' E, alt. 5030 m alt., on *Kobresia pygmaea* mat, 2.ix.1995, G. & S. Miehe 95-01-24A (GZU); *loc. id.*, G. & S. Miehe 95-01-24B (GOET).

***Lethariella zahlbruckneri* (Du Rietz) Krog**

TLC: Atranorin, canarione, norstictic acid, gyrophoric acid (trace).

Notes: Figs 6a & b in OBERMAYER (1997) do not show *Lethariella zahlbruckneri*, as stated, but *L. cashmeriana*.

Specimens examined: —CHINA. *Tibet:* Xizang, Qamdo, alt. 4300 m, 2.vii.1976, *Li Wen-hua* 76-95-(1) (HMAS; small part of the type material of *L. sinensis*). *NW Sichuan:* Upper Yalong basin, Chola Shan, Dege to Garze, Manigango, 31°52'N, 99°07'E, alt. 4180 m, 32° E-facing fir forest on boulder slope, on bark, 27.ix.1994, *U. Wündisch* 94-457-2m (GZU); *loc. id.*, *U. Wündisch* 94-457-2n (GZU); *loc. id.*, alt. 4100 m, N-facing *Picea* forest on boulder slope, on bark, *U. Wündisch* 94-452-1D (GZU).

Acknowledgments

I am much indebted to Per Magnus Jørgensen, Josef Hafellner, Werner Greuter and Gintaras Kantvilas for valuable comments and helpful discussion on the manuscript. Thanks are also due to Peter Kosnik for TLC assistance and to Sabine and Georg Miehe, Ubbo Wündisch and Bernhard Dickoré for providing me with Tibetan specimens. An expedition to Southeast Tibet in 1994 was supported by the Austrian Science Fonds (P09663-BIO).

References

- HUNECK, S. (1991): New results in the chemistry of lichens. *Symbiosis* **11**: 225–248.
- HUNECK, S. & FREMBGEN, J. W. (1989): Zur Chemie der Flechte *Lethariella cladonioides* und einige ethnobotanische Bemerkungen. In: Naswar. J. Der Gebrauch von Mundtabak in Afghanistan und Pakistan (J. W. FREMBGEN). *Schriftenreihe der Stiftung Bibliotheca Afghanistanica* **8**: 91–93.
- KROG, H. (1976): *Lethariella* and *Protousnea*, two new lichen genera in Parmeliaceae. *Norwegian Journal of Botany* **23**: 83–106.
- OBERMAYER, W. (1995): Lichenotheca Graecensis, Fasc. 2 (Nos 21 - 40). *Fritschiana* **3**: 1– 8.
- OBERMAYER, W. (1996): Remarks on the lichen genus *Lethariella*. (Lichenological results of the Sino-German-Joint-Expedition to southeastern- and eastern-Tibet 1994. III.) *The Third Symposium IAL 3, Progress and Problems in Lichenology in the Nineties*, Salzburg, Austria, 1–7. September 1996, Abstracts: 8.
- OBERMAYER, W. (1997): Studies on *Lethariella* with special emphasis on the chemistry of the subgenus *Chlorea*. *Bibliotheca Lichenologica* **68**: 45–66.
- OBERMAYER, W. (1998): Lichenotheca Graecensis, Fasc. 6 (Nos 101–120). *Fritschiana* **16**: 1–6.
- SUN, H., NIU, F., LIN, Z., CAO, D., LI, B. & WU, J. (1990): Chemical constituents of four medicinal lichens. *Acta Botanica Sinica* **32**(10): 783–788. [In Chinese.]
- WEI, J.-C. & JIANG, Y.-M. (1982): New materials for lichen flora from Xizang. *Acta Phytotaxonomica Sinica* **20**(4): 496–501. [In Chinese.]
- WEI, J.-C., WANG, X.-Y., WU, J.-L., WU, J.-N., CHEN, X.-L. & HOU, J.-L. (1982): *Lichenes officinales Sinenses*. Science Press, Beijing. [In Chinese.]