

Süßwasserflora von Mitteleuropa

Freshwater Flora of Central Europe

Begründet von/Founded by A. Pascher

Herausgegeben von/Edited by

Burkhard Büdel · Georg Gärtner · Lothar Krienitz · Hans R. Preisig ·
Michael Schagerl

Band/Volume 1, 2. Aufl./2nd ed.

Jørgen Kristiansen

Hans R. Preisig

Chrysophyte and Haptophyte Algae

2. Teil/2nd Part: Synurophyceae

Chrysophyte and Haptophyte Algae

2. Aufl./2nd ed.

2. Teil/2nd part: Synurophyceae

Jørgen Kristiansen

Hans R. Preisig

690 Abbildungen / figures

Spektrum
AKADEMISCHER VERLAG

Authors' addresses:

Assoc. prof. emerit. Jørgen Kristiansen, Institute of Biology, Section of Phycology, University of Copenhagen, Øster Farimagsgade 2 D, 1353 Copenhagen K, Denmark (joergenk@bi.ku.dk)

Professor Dr. Hans R. Preisig, Institute of Systematic Botany, University of Zürich, Zollikerstrasse 107, 8008 Zürich, Switzerland (preisig@systbot.uzh.ch)

Notice for the reader

The Authors, the Editors, and the Publisher of this work have made every effort to ensure that the information herein is accurate and in accord with the standards accepted at the time of publication. The Publishers have made an extensive effort to trace original copyright holders for permission to use borrowed material. If any has been overlooked, it will be corrected at the first reprint.

Bibliographic information published by Die Deutsche Bibliothek

Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie; Detailed bibliographic data is available in the Internet at <http://dnb.ddb.de>.

All rights reserved

Springer is a part of Springer Science + Business Media
springer.de

© Springer-Verlag Berlin Heidelberg 2007

Spektrum Akademischer Verlag is an Imprint of Springer

07 08 09 10 11 5 4 3 2 1

All rights, including translation, are reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any other form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior written permission of the publisher.

Project managing editor: Ulrich Moltmann, Heidelberg

Project development editor: Christoph Iven, Heidelberg

Book production: Detlef Mädje, Heidelberg

Cover Design: SpieszDesign, Neu-Ulm

Graphics and Photographs: by the authors if not stated otherwise in the figure captions

Composed by: Mitterweger & Partner, Plankstadt

Printed and bound by: LegoPrint S.p.A., Lavis

The book is printed in Italy

ISBN 978-3-8274-1701-5

Preface

The present volume of the Süßwasserflora von Mitteleuropa/Freshwater Flora of Central Europe on Synurophyceae replaces the corresponding outdated parts on the family Synuraceae in the volume on Chrysophyceae and Haptophyceae by Starmach (1985).

The need of a replacement has become increasingly obvious, as the volume mentioned was mainly based on light microscopy, whereas electron microscopy of the silica structures now has become the basis for taxonomy and identification in the Synurophyceae and has also resulted in numerous additional taxa. Accordingly, keys and descriptions have been totally revised, and the illustrations now include electron micrographs of the silica structures for all taxa, in addition to habitus figures drawn from the light microscope.

The Class Synurophyceae as treated here now comprises 220 species and sub-specific taxa, i.e. 180 of *Mallomonas*, 30 of *Synura* and the single species of *Chrysodidymus* and *Tessellaria*, but also included are 6 dubious species of *Conradiella* and the single species of *Pseudosyncrypta* and *Jaoniella*, which have only been described by light microscopy. Not included are five fossil species of *Mallomonas* and one of *Synura*, the names of which are listed at the end of the respective chapters (p. 92 and 120).

In comparison, Starmach's 1985 edition included 183 taxa, i.e. 152 of *Mallomonas* (including 11 of *Mallomonopsis*), 25 of *Synura* (including 1 of *Catenochrysis*), and 6 of *Conradiella*. 37 of these taxa have been synonymized with some of the 220 taxa recognized in the present edition. The genera *Microglena* (5 species), *Chrysosphaerella* (7 species) and *Spiniferomonas* (9 species), which were classified in the Synuraceae by Starmach have been removed from the Synurophyceae. Furthermore, 68 of the 183 *Mallomonas* and *Synura* taxa of Starmach had to be deleted, because they could not be identified from the original light microscopical descriptions.

A large number of additional taxa described by light microscopy but not mentioned by Starmach we also considered to be undeterminable. The present volume ends with a list of totally 507 described species and subspecific taxa, i.e. the 220 taxa we included in this class, plus many synonyms and taxa with dubious or undeterminable affinities and others previously considered having synurophycean affinities but now classified elsewhere.

As in other volumes in the series, this volume is not restricted to European taxa, but includes the whole world. European taxa are highlighted by bold typography. 135 taxa (i.e. 104 of *Mallomonas*, 23 of *Synura*, 1 of *Chrysodidymus*, plus the 6 dubious species of *Conradiella* and the single species of *Pseudosyncrypta*) have been reported from Europe. Twelve of the 127 taxa of *Mallomonas* and *Synura* have so far been recorded exclusively from Europe and are possibly endemic. Most of the other taxa occurring in Europe have a northern temperate distribution and have also been reported from North America, 40 taxa are cosmopolitan or almost so. Of the remaining 85 taxa, several will certainly sooner or later also be found in Europe, other mainly tropical species almost

VI Preface

certainly not. A limit between these two groups cannot be drawn; accordingly this survey covers the whole world.

We hope that this book will be a useful tool in chrysophyte research worldwide.

Jørgen Kristiansen & Hans R. Preisig

Contents

Preface	V
General part	1
Systematic part	8
Family Mallomonadaceae	9
<i>Mallomonas</i>	9
<i>Conradiella</i>	97
Family Synuraceae	99
<i>Chrysodidymus</i>	99
<i>Jaoniella</i>	100
<i>Pseudosyncrypta</i>	101
<i>Tessellaria</i>	102
<i>Synura</i>	103
References	124
Sources of Illustrations	153
Plates	158
Subject index	236
Check-list of Synurophyceae	237

Distribution: Scattered. Europe: Czech Rep., Germany, Netherlands, UK. – North America, East Asia.

Sectio *Insignes* Asmund & Kristiansen 1986

No dome, v-rib present. Apical and caudal scales with spine *insignis* (30)

Mallomonas insignis Penard 1919

Fig. 12, Pl. 5 j-l

(*M. torulosa* Kisselev 1931, *M. mesolepis* Skuja 1934, *M. mesolepis* var. *spinosa* Matvienko 1938a, *M. sophiae* Czosnowski 1948, *M. insignis* var. *sophiae* (Czosnowski 1948) Bourrelly 1957, *M. insignis* var. *lacustris* Bourrelly 1957)

Cells large, elongate-ellipsoidal, tapering to a tail. Both apical and caudal spines, but bristles absent. 25–100 × 14–28 μm.

Body scales from ellipsoidal to almost circular. Dome absent, v-rib with rounded angle. Proximal border and posterior flange with struts. Shield with honeycomb pattern, except for the central papillate area. Apical scales prolonged into a stout spine, caudal scales smaller, with a thin spine. 3.3–5.5 × 2.7–9.0 μm.

Cysts almost spherical, 25–30 × 14–28 μm.

Distribution: Scattered but widespread. Europe: Austria, Czech Rep., Denmark, Finland, France, Germany, Hungary, Latvia, Netherlands, Poland, Portugal, Romania, Russia, Slovakia, Sweden, Switzerland, UK, Ukraine. – North America, Asia and Australia.

Sectio *Retrorsae* Siver 1988

No dome, v-rib present. Scales backwards oriented *retrorsa* (30)

Mallomonas retrorsa Siver 1988

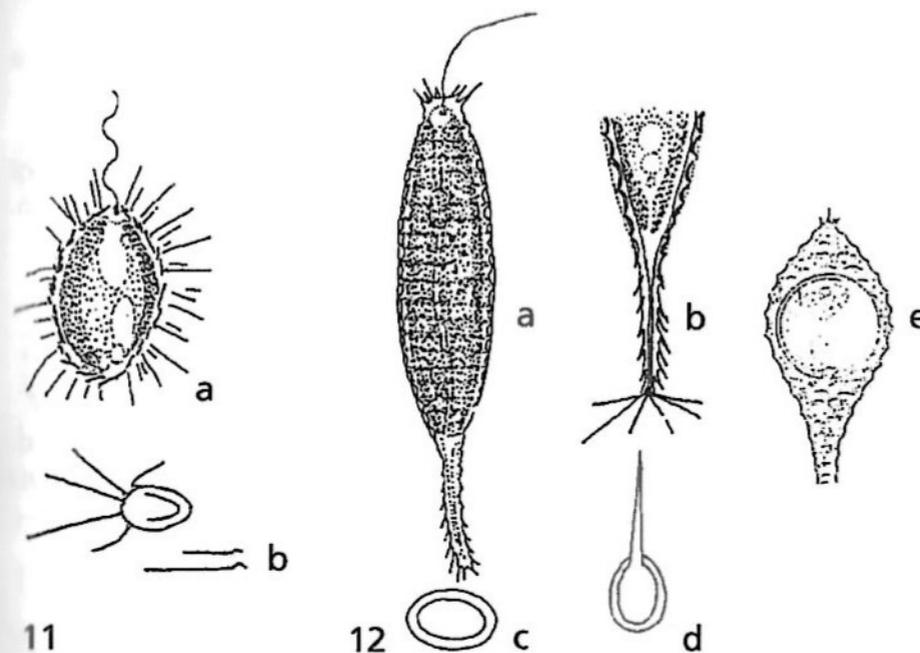
Pl. 5 m-o

Cells lanceolate to spindle-shaped, with an apical tuft of short paddle-like bristles. 20–35 μm long.

Scales backwards oriented. No dome. There is a broad u-shaped v-rib; proximal flange and proximal border asymmetrical. Shield with small pores. Apical scales elongated, bearing the short bristles. Caudal scales with one branch of the v-rib prolonged into a long spine. Body and apical scales 2.9–5.5 × 1.8–3.3 μm, caudal scales up to 8 μm long.

Bristles short and flat, only attached to the apical scales, 3.0–4.5 μm.

Distribution: Only known from Eastern North America.



Figs 11–12. – Fig. 11. *Mallomonas ouradion*: a: Whole cell and b: scale with bristles (Harris & Bradley 1958). – Fig. 12. *Mallomonas insignis*: a: Whole cell; b: posterior part of cell; c: body scale and d: caudal scale; e: cyst inside scale cover (Penard 1919).

Sectio *Quadratae* Momeu & L.S. Péterfi 1979

Scales very thick, with internal structure. No dome, no v-rib, but proximal border present. Body scales rhombic.

1a Scales without pits or grooves (or with very few)

2a Without bristles *adamas* (32)

2b With 2–4 bristles at each end *splendens* (32)

1b Scales with pits or grooves

2a Pattern of several rounded pits

3a Anterior scales rounded

4a Pits arranged in two curved rows *lychenensis* (32)

4b Pits in a v-pattern *allorgei* (34)

3b Anterior scales elongated and curved

4a Pits along proximal border *maculata* (34)

4b Pits in an irregular pattern *formosa* (34)

2b Only one or two pits

3a One very large, irregular, central pit *fenestrata* (35)

3b Two small, rounded pits *parana* (34)

Mallomonas adamas K. Harris & D.E. Bradley 1960

Fig. 13, Pl. 6 a

Cells rounded ovoid, without bristles, 13–27 × 11–17 µm.

Scales rounded, with an internal reticulate pattern and a superficial pattern of papillae with one or few pits. Rear scales with backwards pointing projection.

No dome. Asymmetrical v-rib and broad flange. 6–9 × 3.5–5.0 µm.

Cysts ellipsoidal, 13–20 × 13–15 µm.

Distribution: Scattered. Europe: Czech Rep., UK. – Asia, Australia.

Mallomonas splendens (G.S. West 1909) Playfair 1912 emend. Croome, Dürschmidt & P.A. Tyler 1985 (*Lagerheimia splendens* G.S. West 1909)

Fig. 14, Pl. 6 b–c

Cells long and cylindrical, with 2–4 bristles at each end.

Body scales thick, rhombic, with broad proximal border and weak v-rib; no anterior submarginal rib. Internal meshwork and papillose surface without pits. Apical and caudal scales with asymmetric dome.

Distribution: Scattered, Europe: UK – first misinterpreted as a green alga. – Asia, Australia.

Mallomonas splendens f. *arnhemensis* Croome, Dürschmidt & P.A. Tyler 1985

Pl. 6 d

Differs by a circular pit in the angle of the v-rib,
Distribution: Tropical (Australia and S.E.Asia).*Mallomonas lichenensis* W. Conrad 1938 a

Fig. 15, Pl. 6 e–h

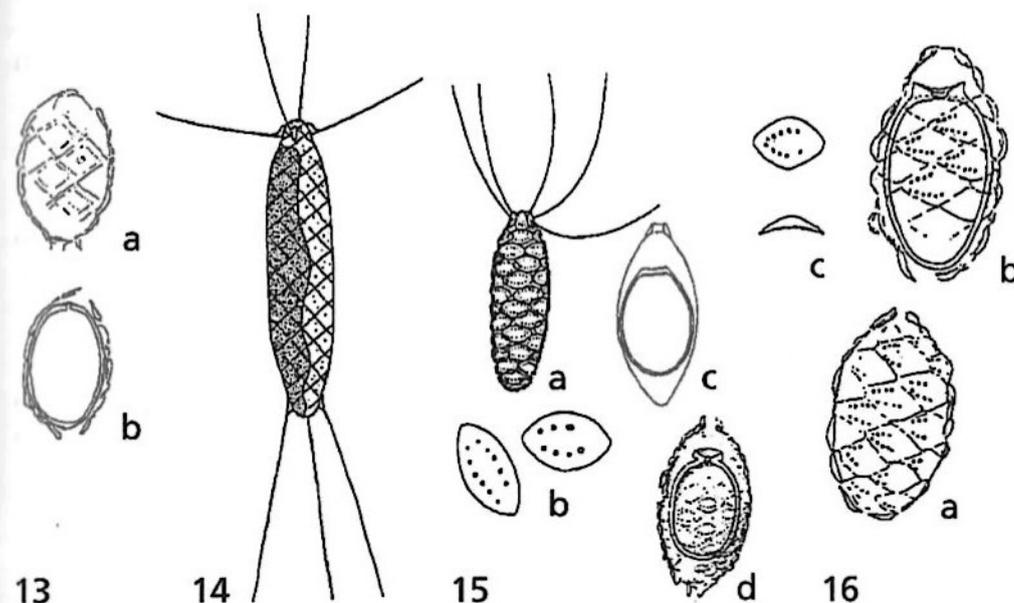
(M. robusta Matvienko 1941, *M. tessellata* Nygaard 1945, 1949, *M. lichenensis* var. *tessellata* (Nygaard 1945) Bourrelly 1957)

Cells ovoid with a distal crown of bristle-bearing scales, 12–40 × 8–16 µm.

Body scales thick, elliptic, covered with papillae and with an internal reticulum.

Strong proximal border, but no v-rib. Shield with up to ten conspicuous pits arranged in two curved rows. Apical scales rounded, with a bulged lobe surrounding the flagellar pit. Caudal scales with short spines. 3–10 × 2–6 µm.

Bristles thin and curved, attenuated, 9–30 µm.



Figs 13–16. – Fig. 13. *Mallomonas adamas*: a: Whole cell; b: cyst inside cell cover (Harris & Bradley 1960). – Fig. 14. *Mallomonas splendens*: Whole cell (Conrad 1933). – Fig. 15. *Mallomonas lichenensis*: a: Whole cell, b: single scales; c: collarless cyst inside scale cover (Nygaard 1949; as *M. tessellata*); d: cyst with collar (Conrad 1938a). – Fig. 16. *Mallomonas allorgei*: a: Whole cell; b: cyst inside scale cover; c: single scales (Conrad 1933).

Cysts ellipsoidal, rounded at both ends, porus with or without collar. 17–23 × 11–16 µm. Zygotes spherical, 12 µm diam.

Distribution: Widely distributed. Europe: Austria, Belgium, Denmark, France, Hungary, Netherlands, Norway (?), Romania, Slovakia, Sweden, Switzerland, UK, Ukraine. – North and South America, Africa and Australia.

Mallomonas lichenensis f. *ecuadorensis* Wujek & Dzedzik 2005

Pl. 6 i

Distinguished by the very large pits on the shield.

Distribution: Only known from South America (Ecuador).

Mallomonas lichenensis f. *symposiaca* Skogstad & Kristiansen 1996

Pl. 6 j

The two rows of pits on the middle body scales have fused to two irregular channels.

Distribution: Only known from Europe: Denmark.

Plate 6. Mallomonas, Quadratae 1.

a. *Mallomonas adamas*. – Body scale (UK, Harris & Bradley 1960).

b–c. *M. splendens*. – b: Body scale (Australia, Croome in Asmund & Kristiansen 1986). – c: Whole cell (Australia, Croome & al. 1984).

d. *M. splendens* f. *arnhemensis*. – Body scale (Australia, Croome & al. 1984).

e–h. *M. lychenensis*. – e: Body scale. – f: Apical scale (Denmark, Asmund & Kristiansen 1986). – g: Whole cell (Denmark, Skogstad & Kristiansen 1996). – h: Caudal scale (Denmark, Asmund & Kristiansen 1986).

i. *M. lychenensis* f. *ecuadorensis*. – Body scale (Ecuador, Wujek & Dziedzic 2005)

j. *M. lychenensis* f. *symposiaca*. – Body scales, SEM (Denmark, Skogstad & Kristiansen 1996).

k–m. *M. allorgei*. – k: Body scale. – l: Detail of scale cover, SEM. – m: Caudal scale (Denmark, Asmund & Kristiansen 1986).

