

***MALLOMONAS STRIATA* VAR. *SERRATA* AND *SYNURA PETERSENII* F. *KUFFERATHII*, TWO SILICA-SCALED CHRYSOPHYTES NEW TO CAMEROON**

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Abstract. *Mallomonas striata* Asmund var. *serrata* K. Harris & D. E. Bradley and *Synura petersenii* Korshikov f. *kufferathii* J. B. Petersen & J. B. Hansen are reported from a marshy swamp by a stream in the Guineo-Congolian tropical rainforest in eastern Cameroon. They are described and illustrated with LM and SEM micrographs. Both taxa are reported for the first time from Cameroon.

Key words: Synurophyceae, *Mallomonas*, *Synura*, Guineo-Congolian tropical rainforest, Cameroon

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INTRODUCTION

Silica-scaled chrysophytes belong to the order Synurales R. A. Andersen and class Synurophyceae R. A. Andersen. This group of chrysophytes has several characters that distinguish them from the related class Chrysophyceae Pascher, such as the presence of endogenously generated, species-specific silica scales, characteristic flagellar apparatus, and chlorophyll *c* composition (Kristiansen & Preisig 2001, 2007). The diversity of silica-scaled chrysophytes is unevenly investigated. They are relatively well known in the subarctic and temperate zones, but insufficiently recognized in tropical ecosystems. In the available literature we found that in Africa (including Madagascar) 43 taxa of silica-scaled chrysophytes are known, belonging to three genera: *Chryso-didymus* Prowse (1 species), *Mallomonas* Perty (34 taxa) and *Synura* Ehrenb. (8 taxa). Most of them were recorded mainly from Southeast Africa (Cronberg & Hickel 1985; Cronberg 1989, 1996; Hansen & Kristiansen 1995; Kristiansen & Preisig 2007), but some also from West Africa (e.g., Compère 1975; Wujek *et al.* 2004).

During phycological fieldwork in eastern Cameroon in December 2007, the first author collected phytoplankton and sediment samples from different habitats in the Guineo-Congolian tropical rainforest. Several samples contained silica-scaled chrysophytes. Here we report two species, *Mallomonas striata* Asmund var. *serrata* K. Harris & D. E. Bradley and *Synura petersenii* Korshikov f. *kufferathii* J. B. Petersen & J. B. Hansen, which are new to Cameroon. Both taxa were observed and are described and illustrated by light microscopy (LM) and scanning electron microscopy (SEM).

MATERIALS AND METHODS

Sediment samples intermixed with plant remnants were collected on 15 December 2007 from a marshy swamp by a stream flowing in tropical rainforest in eastern Cameroon. The samples were fixed with Lugol solution and examined in the laboratory. Water temperature (°C), conductivity ($\mu\text{S}\cdot\text{cm}^{-1}$) and pH were measured once, immediately after collection. Temperature and conduc-



Fig. 1. General view of the collection site: marshy swamp by Talimbé stream in eastern Cameroon, dominated by *Pandanus candelabrum* P. Beauv. and *Halopegia azurea* K. Schum. (photo Marcin Piątek).

tivity were measured with a CC-102 conductivity meter (Elmetron IP67), and pH with a CP-103 waterproof pH-meter (Elmetron IP67).

Examination and identification were by standard light and phase contrast microscopy (LM) and scanning electron microscopy (SEM). For LM, slide preparations mounted in water were studied under a Nikon Eclipse 600 light microscope with Nomarski interference contrast. Micrographs were taken with a Nikon DS-Fi1 camera. For SEM, each sample was pipetted onto clean cover glasses, air-dried, and affixed to an aluminum stub with double-sided transparent tape. The stubs were sputter-coated with carbon using a Cressington sputter-coater and viewed with a Hitachi S-4700 scanning electron microscope.

The description of *Mallomonas* species follows the terminology of Siver (1991), Kristiansen (2002), and Kristiansen and Preisig (2007). The description of *Synura* species follows the terminology of Kristiansen and Preisig (2001, 2007). All measurements of the cells and their scales are from slide preparations studied by LM and directly from LM and SEM micrographs.

DESCRIPTION OF STUDY AREA

The samples were collected in eastern Cameroon (East Province, Department of Lom and Djérem) in a marshy swamp (04°41'13,1"N, 13°38'29,7"E, ca 682 m a.s.l.) by Talimbé stream, between Koumé and Koundi villages ca 13 km NW of Bertoua. The habitat consists of streamside vegetation forming an open marsh community dominated by *Pandanus candelabrum* P. Beauv. and *Halopegia azurea* K. Schum. and surrounded by the Guineo-Congolian tropical rainforest (Fig. 1). The samples were collected from microhabitat partially shaded by overgrown patches of *Leersia hexandra* Sw. The water was black, with temperature 22.5°C, conductivity 35 $\mu\text{S}\cdot\text{cm}^{-1}$ and pH 6.7. In the near vicinity the water was used for laundry and washing. *Mallomonas striata* var. *serrata* and *Synura petersenii* f. *kufferathii* co-occurred with other algae, especially with many different taxa of

Bacillariophyceae as well as colored and colorless Euglenophyta.

RESULTS AND DISCUSSION

Mallomonadaceae Diesing

Mallomonas striata Asmund var. *serrata* K. Harris & D. E. Bradley Figs 2–4

LM DESCRIPTION: Cells ovoid, 20.0 µm long and 8.75–9.4 µm wide, with bristles and at least one chloroplast. Bristles 8.5–11.0 µm long.

SEM DESCRIPTION: The examined cells were 15.0 µm long and 8.9 µm wide. Scales elliptical, tripartite, composed of a dome, shield and flange. V-rib continuous with anterior submarginal rib separating the shield from the posterior flange. Scales 4.2–4.4 µm long and 2.2–2.7 µm wide. Domes U-shaped, smooth or ornamented with usually 3 or 4 curved ribs. Scales have 10 or 11 transverse ribs on the shield, 10–12 ribs on the posterior flange, and 5 or 6 ribs on the anterior flange. Serrate bristles 7.1–10.2 µm long and 0.4 µm wide, with short, pointed teeth.

NOTES. *Mallomonas striata* var. *serrata* is a cosmopolitan species (Kristiansen 2002; Kristiansen & Preisig 2007), very common in Europe, North and Central America, also often recorded from South America, but only rarely found in Asia, Australia and Africa. From Africa it was reported only from three countries: Botswana, Madagascar and Zimbabwe. The first finding was made by Cronberg (1989), who observed it in small eutrophic ponds in Zimbabwe. Later, Cronberg (1996) found *M. striata* var. *serrata* in six different locations in Botswana, and Hansen (1996) recorded it from Madagascar. *Mallomonas striata* var. *serrata* is reported here for the first time from Cameroon and from Central Africa.

In African localities, *Mallomonas striata* var. *serrata* was usually found in small eutrophic water bodies (swamps, isolated pools, channel, lagoon). Very often the water from these localities was used as water holes for cattle, washing clothes, and also drinking. Water temperature ranged from 23.1°C

to 34.4°C, conductivity 88.4 to 180 µS·cm⁻¹, and pH 6.3 to 7.2 (Cronberg 1989, 1996). Similar environmental conditions characterized the Cameroonian station, where *M. striata* var. *serrata* occurred in a weakly acidic swamp of low conductivity; people used the water from this swamp for washing clothes and themselves.

Synuraceae Lemmerm.

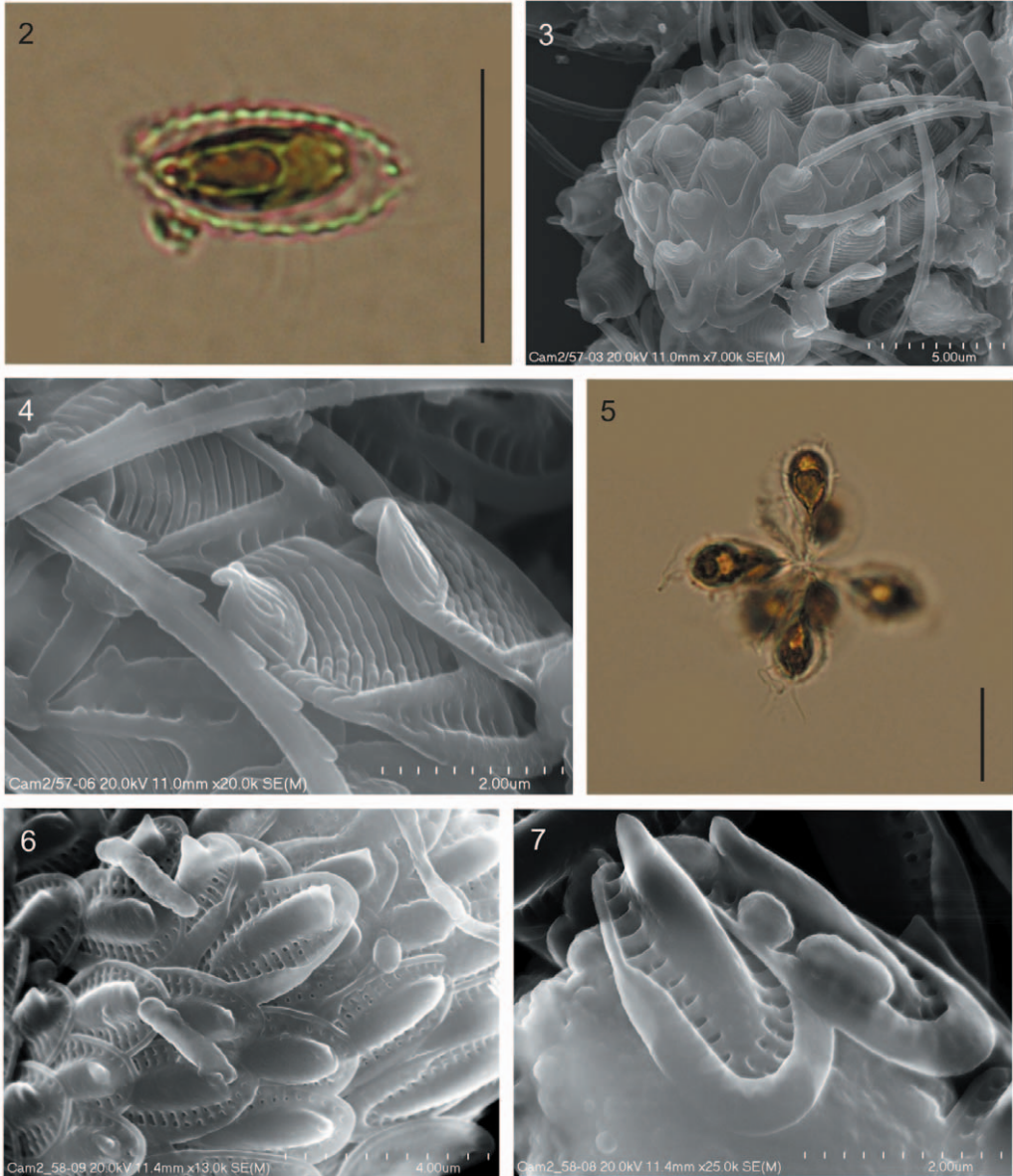
Synura petersenii Korshikov f. *kufferathii* J. B. Petersen & J. B. Hansen Figs 5–7

LM DESCRIPTION: Colony spherical, ca 55 µm in diameter, composed of cells 24 µm long and 10 µm wide, each cell having two flagella.

SEM DESCRIPTION: Cells 24.0 µm long and 10.4 µm wide. Scales 3.2–3.9 µm long and 1.8–2.2 µm wide. Within the same cell, the central/dorsal ridge of the scales (2.7–2.9 µm long and 0.6–0.7 µm wide) usually has an acute apex (Fig. 6), but rarely a blunt apex (rather typical of f. *prae-fracta*, Fig. 7). The scales have longitudinal ribs connected by transverse struts.

NOTES. Form *kufferathii* differs from the nominative form by having a dorsal ridge with an acute apex and longitudinal ribs connected by transverse struts. *Synura petersenii* f. *kufferathii* is very similar to *Synura petersenii* f. *prae-fracta* Asmund. Both have scales with characteristic longitudinal ribs connected by transverse struts, but the dorsal ridge in form *kufferathii* has an acute apex, while the dorsal ridge in form *prae-fracta* has a blunt apex. In the Cameroonian specimen, within the same cell most scales have a dorsal ridge with an acute apex (Fig. 6), but some scales have a dorsal ridge with a blunt apex (Fig. 7). We identified this specimen as f. *kufferathii* because of the prevalence of scales with an acute apex on the dorsal ridge.

Synura petersenii f. *kufferathii* is widely distributed, found on four or five of the six continents (Kristiansen 2000). In tropical regions the available literature reports it from Brazil (Cronberg 1989; Menezes & Alves Dias 2001; Menezes *et al.* 2005) and Columbia (Vigna *et al.* 2005). In Africa this taxon was recorded previously from Chad (Com-



Figs 2–7. 2 – Whole cell of *Mallomonas striata* Asmund var. *serrata* K. Harris & D. E. Bradley, by LM. 3 – Whole cell of *Mallomonas striata* var. *serrata* with scales and serrate bristles, by SEM. 4 – Body scales with serrate bristles, by SEM. 5 – Colony of *Synura petersenii* Korshikov f. *kufferathii* J. B. Petersen & J. B. Hansen, composed of cells with scales and flagella, by LM. 6 – Body scales of *Synura petersenii* f. *kufferathii* with a typical dorsal ridge with an acute apex. 7 – Body scales of *Synura petersenii* f. *kufferathii* with scales having a dorsal ridge with a blunt apex, by SEM. Scale bars for LM = 20 μm (Figs 2 & 5).

père 1975), Botswana, Madagascar, Zimbabwe (Cronberg 1996) and Nigeria (Wujek *et al.* 2004). *Synura petersenii* f. *kufferathii* is reported here for the first time from Cameroon.

In Africa, *Synura petersenii* f. *kufferathii* was usually found in oligo- and mesotrophic water bodies, swamps and an artificial lake (Cronberg 1989, 1996). The chemical and physical

parameters given for one locality in Botswana were as follows: water temperature 23.5°C, conductivity 120 $\mu\text{S}\cdot\text{cm}^{-1}$ and pH 6.3 (Cronberg 1996). The environmental conditions were similar at the Cameroonian station, where *S. petersenii* f. *kufferathii* occurred in a weakly acidic swamp of conductivity even lower (35 $\mu\text{S}\cdot\text{cm}^{-1}$) than in Botswana.

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