^{3th International Chrysophyte Symposium}

August 12 - 17, 2012

Charles University in Prague

Czech Republic

General Program & Book of Abstracts

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Eighth International Chrysophyte Symposium

Charles University in Prague, Faculty of Science, Czech Republic 12-17 August 2012

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General Program

16:00-20:00

Sunday 12. 8. 2012

Registration

Monday 13. 8. 2012	
8:00-10:00	Registration
9:00	Welcome and opening remarks by Yvonne Němcová and Jiří Zima (vice-dean of the Fac-
	ulty of Science, Charles University in Prague).
	Keynote Presentation (Chairperson: A.M. Lott)
9:15	Siver, P.A.: Do scaled chrysophytes have a biogeography? Evidence from North America.
10:15	Coffee break
	Species concepts and phylogeny – new advances and insights
	(Chairperson: H.S. Yoon)
10:30	Julius, M., Chanthirath, I., Stepanek, J.: A preliminary multi-gene phylogeny for the
	Chrysophyte algae.
11:00	Scoble, J., Cavalier-Smith, T.: New insights into colourless scaly chrysophyte taxonomy;
	'Butchering' the species-rich and morphologically diverse Paraphysomonas to make
	three new genera, Clathromonas, Acanthomonas and Patellomonas.
11:30	<u>Škaloud, P.</u> , <u>Škaloudová</u> , M.: Tracing the evolution and species diversification rates with-
	in the genus <i>Synura</i> (Stramenopiles).
12:00	Lunch
	Species concepts and phylogeny – new advances and insights
	(Chairperson: J. Neustupa)
13:40	Němcová, Y., Kreidlová, J., Pusztai, M., Neustupa, M.: Mallomonas pumilio group - a
	revision based on the scale/scalecase morphology and geometric morphometric data.
14:05	Poulíčková, A.: Diatom reproductive biology and phylogenetic consequences.
14:30	Urbánková, P., Veselá, J.: DNA barcoding: a case study in the diatom genus Frustulia.
14:55	Coffee break
	Biodiversity and distribution – geographic and ecological patterns (Chairperson: A.M. Lott)
15:15	Škaloud, P., <u>Škaloudová, M.</u> , Pichrtová, M., Němcová, Y., Kreidlová, J., Pusztai, M.:
	www.chrysophytes.eu - distribution and ecology of silica-scaled chrysophytes in Europe.
15:40	Gusey, E.: Studies on Synurophycean algae from tropical wetlands on example of Central
	and Southern Vietnam.
16:05	Kristiansen, J., Siver, P.: Hans Preisig and Craig D. Sandgren - look back on scientists who
	moved the chrysophyte research forward.
16:30	Proposals for ICS9.
19:00	Welcome party (Botanical garden)

	Tuesday 14. 8. 2012	
9:00	Introductory remarks, announcements and updates.	
	Keynote Presentation (Chairperson: E. Rott)	
9:10	Weisse, T.: Sex, cysts, and local adaptation in freshwater protists.	
10:10	Coffee break	
	Biodiversity and distribution – geographic and ecological patterns (Chairperson: Y. Němcová)	
10:30	Rott, E.: Functional species groups of freshwater planktonic chrysophytes revisited.	
11:00	Klaveness, D.: Hydrurus in nature and in culture: an overview.	
11:30	Siver, P.A., Lott, A.M., Wolfe, A.: New species of Synura from the Paleogene.	
12:00	Lunch	
	Biodiversity and distribution - geographic and ecological patterns (Chairperson: J. Kristiansen)	
13:40	Pang, W., Wang, Y., Wang, Q.: Chrysophycean stomatocysts from the Great Xing'an Mountains, China.	
14:05	Jordan, R.W., Abe, K., Stickley, C.E.: Diversity of Middle Eocene stomatocysts from the central Arctic Ocean.	
14:30	Wang, Q., You, M., Pang, W.: Chrysophycean stomatocysts from the Stone Ponds in the Aershan National Geological Park, China.	
14:55	Coffee break	
	Biodiversity and distribution - geographic and ecological patterns (Chairperson: E. Rott)	
15:15	Johansson, K., Trigal, C., Vrede, T., van Rijswijk, P., Goedkoop, W., Johnson, R.K.: Effects of <i>Gonyostomum</i> semen blooms on boreal lake food webs.	
15:40	Hernández-Becerril, D.U., Salazar-Paredes, J.: Abundance and distribution of the marine planktonic species <i>Tetraparma insecta</i> (Parmales) in the Gulf of California (July-August, 2011).	
16:05	Wei, Y.X., Yuan, X.P.: Studies on silica-scaled chrysophytes from the Daxinganling Moun- tains and Wudalianchi Lake Regions, China.	
16:30	Neustupa, J.: Adolf Pascher's correspondence. Introduction of the web project.	
17:00	Poster session	
19:00	Beer trip	

Wednesday 15. 8. 2012		
8:30; 9:00	Excursions	
19:00	Microscopy session	

	Thursday 16. 8. 2012
9:00	Introductory remarks, announcements and updates.
	Keynote Presentation (Chairperson: M. Eliáš)
9:10	Worden, A.Z.: Eukaryotic algae and ecosystem dynamics.
10:10	Coffee break
	Evolutionary genomics and protist evolution (Chairperson: M. Julius)
10:30	Yoon, H.S., Yang, E.C., Boo, S.M., Andersen, R.A.: Phylogeny of photosynthetic hetero- kont algae.
11:00	Eliáš, M., Hasíková, T., Zbránková, V., Přibyl, P., Fousek, J., Vlček, Č.: The genomic per- spective on the biology and evolution of the eustigmatophyte algae.
11:30	Oborník, M., Kořený, L., Cihlář, J.: Tetrapyrrole pathway as a marker for evolution of complex plastids.
12:00	Lunch
	Phenotypic plasticity and shape variation in chrysophyte algae (Chairperson: T. Weisse)
13:40	Siver, P.A.: Examination of scale shape in <i>Mallomonas insignis</i> using geometric morpho- metrics: Evidence for evolutionary stasis in scale ultrastructure.
14:05	Neustupa, J., Škaloudová, M., Škaloud, P.: Patterns of morphological integration in scales of <i>Synura macracantha</i> and <i>S. petersenii</i> concur with their different evolutionary age.
14:30	Pichrtová, M., Němcová, Y.: Effect of temperature on shape and size of synurophyte silica scales - a geometric morphometric approach.
14:55	Coffee break
	Life cycle changes and community dynamics in heterokont algae (Chairperson: P.A. Siver)
15:15	Woodard, K., <u>Veselá, J.</u> : Quantification of morphological changes during the life cycle of diatoms.
15:40	Yucel, N., Uysal, Z., Tugrul, S.: Phytoplankton pigment partitioning in shelf waters of the oligotrophic north eastern Mediterranean – Contribution of 19'-Butanoyloxyfuco- xanthin to the bulk.
16:05	Neustupa, J.: Proceedings of the ICS 2012 symposium. General information.
16:20	Closing of the symposium
19:00	Farewell party

	Friday 17. 8. 2012
9:00	Kutná Hora Excursion

List of Posters

Gusev, E.: Flora and ecology of chrysophytes from low-mineralized karst lakes in Central Russia.

Herlitz, E., Quintana, I., Stehn, A., Sunna, M.E.: Some single-celled loricate chrysophytes in Swedish lakes. Part I and II.

Herlitz, E., Quintana, I., Stehn, A., Sunna, M.E.: Problematic Dinobryon in Swedish lakes.

<u>Jo, B.Y.</u>, Shin, W., Kim, H.S., Andersen, R.A., Siver, P.A.: Phylogeny of the genus *Mallomonas* (Synurophyceae) and descriptions of five new species based on morphological and molecular evidence.

Julius, M., Andersen, R.: Boekelovia: a non-chrysophyte taxon with a complicated nomenclatural history.

Lakatos, G.E., Keresztúri, K., Horváth, B., <u>Maróti, G.</u>: Investigation of the symbiotic interactions between *Chlamydomonas* sp. and various bacterial strains.

Lott, A.M., Siver, P.A.: Morphological variability of chrysophyte cysts from an Eocene maar lake in the Canadian Arctic.

<u>Němcová, Y.</u>, Pusztai, M., Kreidlová, J.: Newly described species of the genus *Mallomonas*.

<u>Pichrtová, M.</u>, Němcová, Y., Škaloud, P., Rott, E.: Scale bearing planktonic chrysophytes from North Tyrol, Austria.

<u>Safronova, T.</u>: Species composition of chrysophytes in the waterbodies of protected areas of the North-West of Russia.

Takahashi, K., Iwataki, M., Jordan, R.W.: Synurophytes in the lakes and ponds of Kenmin-no-mori, Yamagata, Japan.

Wang, Q., Pang, W.: A new species of *Synura* from Genhe, Inner Mongolia, China.

Wei, Y.X., Yuan, X.P.: Studies on silica-scaled chrysophytes from Zhejiang, Jiangsu and jiangxi Provinces, China.

Abstracts

THE GENOMIC PERSPECTIVE ON THE BIOLOGY AND EVOLUTION OF THE EUSTIGMATOPHYTE ALGAE

<u>Eliáš, M.</u>^{1,2}, Hasíková, T.¹, Zbránková, V.¹, Přibyl, P.³, Fousek, J.⁴, Vlček, Č.⁴

¹Department of Biology and Ecology, Faculty of Science, University of Ostrava, Ostrava, Czech Republic ²Department of Botany, Faculty of Science, Charles University in Prague, Prague, Czech Republic ³Institute of Botany, Academy of Sciences of the Czech Republic, v.v.i., Třeboň, Czech Republic

⁴Institute of Molecular Genetics, Academy of Sciences of the Czech Republic, v.v.i., Prague, Czech Republic

Eustigmatophytes are a poorly known class of ochrophyte (or heterokont) algae with a distinctive cellular organization and with only little over 20 currently known species. However, recent years have witnessed a renewed interest in eustigmatophytes due to their ability to produce high amounts of oleaginous compounds, particularly polyunsaturated fatty acids. The genus Nannochloropsis has assumed a special position among eustigmatophytes by becoming widely used in various biotechnological applications, which has in the last few years dramatically promoted the basic biological research on several Nannochloropsis species, yielding a recent publication of the full genome sequences for two of them. The talk will summarize the most salient discoveries enabled by these two Nannochloropsis genome projects and will introduce our own recently initiated project to sequence the genome of Trachydiscus minutus, which represents a eustigmatophyte lineage deeply diverged from that of Nannochloropsis. The first interesting results of our work, including a comparative analysis of organellar genomes and the discovery of a putative endosymbiont of T. minutus representing a new genus in the bacterial family Rickettsiaceae, will be discussed.

Presentation

FLORA AND ECOLOGY OF CHRYSOPHYTES FROM LOW-MINERALIZED KARST LAKES IN CENTRAL RUS-SIA

Gusev, E.

Papanin's Institute for Biology of Inland Waters of the Russian Academy of Sciences, Borok, Russia

The taxonomic composition of chrysophyte algae (Synurophyceae and Chrysophyceae) and phytoplankton dynamics were investigated in different types of seven soft-water, weakly-mineralized karst lakes: Kschara, Sankhar, Yukhor, Poridovo, Svetlen'koye, Malye and Bol'shiye Garavy (Vladimir oblast, Central Russia) from year 2002 to 2005. Lakes differ by size, pH, trophic state and water color. The following aspects were studied: seasonal dynamics, vertical distribution of algae, relative algal photosynthetic activity, the relationships between chrysophytes abundance and pH, water transparency, BOD5, concentrations of total forms of nitrogen and phosphorus. Totally 18 taxa including 1 variety of the genus Mallomonas have been recorded and four species belonging to the genus Synura were found. The genus Dinobryon were represented by seven species, Kephyrion comprises 3 taxa. Also a single taxon from the genus Chrysosphaerella has been observed. All lakes have distinct patterns of vertical distribution of golden algae due to strong water stratification. Relationships between abundance of chrysophytes and abiotic factors as well as abundance of the other groups of planktonic algae are discussed. The work was supported by RFBR grant 12-04-00257-a.

Poster

STUDIES ON SYNUROPHYCEAN ALGAE FROM TROPICAL WETLANDS ON EXAMPLE OF CENTRAL AND SOUTHERN VIETNAM

Gusev, E.

Papanin's Institute for Biology of Inland Waters of the Russian Academy of Sciences, Borok, Russia

Silica-scaled flagellates from the class Synurophyceae have been studied from January 2008 to November 2010 in tropical wetlands located in different parts of Vietnam. Four types of wetlands have been examined: mangrove swamps with highmineralized water; sandpits and bogs in Cam Ranh peninsula with dark water and low values of mineralization; floodplain pools along rivers in Khanh Hoa province and wetlands in Cat Tien National Park (Dong Nai province). The use of electron microscopy technique allowed for the discovery of 36 taxa. Totally 25 species and four intraspecific taxa of the genus Mallomonas have been recorded. Five species and one forma belonging to the genus Synura were found. Also a single taxon from the genus Chrysodidymus have been observed. Three Mallomonas taxa are new to the science. One close to Mallomonas bronchartiana Compère, others belong to section Papillosae. Differences in species composition between habitats and morphological features of studied taxa are discussed. The work was supported by RFBR grant 12-04-00257-a and Ecolan 3.2.

Presentation

SOME SINGLE-CELLED LORICATE CHRYSOPHYTES IN SWEDISH LAKES. PART I AND II

Herlitz, E., Quintana, I., Stehn, A., Sunna, M.

Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden

Almost 50 years of work within the Swedish national environmental monitoring, a large variation in the flora of Swedish Chrysophyceae has been revealed within the genera *Bicosoeca*, *Bitrichia*, *Chrysolykos*, *Chrysococcus*, *Dinobryon*, *Kephyrion*, and *Pseudokephyrion*. Some species are easy to identify with common light microscopy, whereas others are more challenging or even impossible to identify with this method. Our scope is to start a discussion on how to proceed to increase our taxonomic knowledge of these groups.

PROBLEMATIC DINOBRYON IN SWEDISH LAKES

Herlitz, E., Quintana, I., Stehn, A., Sunna, M.

Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden

Our work within the Swedish national environmental monitoring includes analysis of samples from different types of lakes, including limed lakes. In our work, we have found some *Dinobryon* specimens difficult to identify. Some of them have a mixture of contradictory taxonomic characters, and we believe we have one species not yet described in the literature. Our scope is to start a discussion on how to proceed to increase our taxonomic knowledge of this group.

Poster

ABUNDANCE AND DISTRIBUTION OF THE MARINE PLANKTONIC SPECIES *TETRAPARMA INSECTA* (PARMALES) IN THE GULF OF CALIFORNIA (JULY-AUGUST, 2011)

Hernández-Becerril, D. U., Salazar-Paredes, J.

Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México (UNAM), Coyoacán, México

Parmales is a small heterokont taxonomic group, traditionally included in the Chrysophytes, although recent studies relate it to Bolidophyceae. It comprises solitary, fairly spherical and marine planktonic cells of nano/picoplanktonic size (2-5 µm diameter), covered by a number of siliceous plates. There are about 20 taxa recognized (species and infraspecies categories), but little is known on their ecology. During an oceanographic cruise in the Gulf of California, Mexico (26 July - 6 August, 2011), environmental variables were measured and phytoplankton samples were taken, to investigate the possible relationships between the oceanographic eddies and the phytoplankton structure in the study area. Bottle samples were filtered to get the preservable fraction of the phytoplankton and filters examined showed populations of the species Tetraparma insecta (Parmales) originally and recently described

Poster

from the Gulf of Tehuantepec, in the tropical Mexican Pacific. In this paper, the abundance and distribution of the species are studied, and the relation with the hydrographic and oceanographic data. Densities of *Tetraparma insecta*, estimated by LM and SEM, yielded up to 2.1×10^3 cells L⁻¹ in one station. The associated flora included small centric diatoms (*Thalassiosira* spp.) and coccolitophorid species. Discussion on the vertical distribution and the environmental factors is made.

Presentation

PHYLOGENY OF THE GENUS *MALLOMONAS* (SYNU-ROPHYCEAE) AND DESCRIPTIONS OF FIVE NEW SPECIES BASED ON MORPHOLOGICAL AND MO-LECULAR EVIDENCE

Jo, B. Y.¹, Shin, W.¹, Kim, H. S.², Andersen, R. A. ³, Siver, P. A.⁴

¹Department of Biology, Chungnam National University, Daejeon, Korea

²Department of Biology, Kyungpook National University, Daegu, Korea

³Friday Harbor Laboratory, University of Washington, USA

⁴Department of Botany, Connecticut College, New London, USA

We used a molecular analysis based on three genes, coupled with the ultrastructure of scales and bristles, to investigate phylogenetic relationships within the genus Mallomonas with a focus on taxa within the section Planae. In addition, fossil taxa of Mallomonas discovered in Middle Eocene lacustrine deposits from northwestern Canada were used to calibrate a relaxed molecular clock analysis and investigate temporal aspects of species diversification within the genus. Five new species, Mallomonas lacuna, M. hexareticulata, M. pseudomatvienkoae, M. sorohexareticulata, and one fossil species, M. pleuriforamen, are described. The new species, all closely aligned with M. matvienkoae, were characterized by the number, distribution and size of base plate pores, the secondary structure found on the scale surface, and differences in bristles. The molecular phylogenetic analysis, inferred using nuclear SSU, LSU rDNA and plastid rbcL sequences, places all of the new species and M. matvienkoae as a strongly supported clade within the section Planae. A Bayesian relaxed clock analysis confirmed that the genus *Mallomonas* diverged into two major clades about 129 Ma in the Early Cretaceous. The earliest diverging lineage within the section Planae was *M. bangladeshica*, followed by *M. heterospina* and *M. oviformis*, and most recently diverged species were *M. sorohexareticulata* and *M. hexareticulata*.

Poster

EFFECTS OF *GONYOSTOMUM SEMEN* BLOOMS ON BOREAL LAKE FOOD WEBS

Johansson, K. S. L.¹, Trigal, C.¹, Vrede, T.¹, van Rijswijk, P.², Goedkoop, W.¹, Johnson R. K.¹

¹Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden

²Centre for Estuarine and Marine Ecology, Royal Netherlands Institute for Sea Research, Yerseke, The Netherlands

Blooms of the raphidophyte Gonyostomum semen have increased dramatically in the Fennoscandian region during the last 40-year period, both in frequency and spatial distribution. By causing skin irritation to swimmers, G. semen reduces the recreational value of many boreal lake ecosystems. Our knowledge about the ecological consequences of an almost complete dominance of G. semen in affected lakes is, however, limited. Due to large cell size and several grazer-avoidance strategies, G. semen is hypothesized to constitute a bottleneck for the transfer of energy and nutrients in the food web during intense blooms. To test this hypothesis, we analyzed the taxonomic composition of pelagic assemblages and the fatty acid composition of predominant zooplankton species in eight chemically and morphometrically similar lakes with and without G. semen blooms. The impacts of G. semen blooms on food web structure and zooplankton diets will be discussed.

Presentation

DIVERSITY OF MIDDLE EOCENE STOMATOCYSTS FROM THE CENTRAL ARCTIC OCEAN Jordan, R. W.¹, Abe, K.², Stickley, C. E.³

¹Department of Earth and Environmental Sciences, Faculty of Science, Yamagata University, Yamagata, Japan

²School of Science and Engineering, Yamagata University, Yamagata, Japan

³Department of Geology, University of Tromsø, Tromsø, Norway

Deep sea drilling cores obtained in summer 2004 from the Lomonosov Ridge in the central Arctic Ocean during Integrated Ocean Drilling Program Expedition 302 contain about 100 m of wellpreserved biosiliceous sediments (including diverse assemblages of chrysophyte stomatocysts) of Middle Eocene age (49-45 Ma). Although total stomatocyst counts were conducted in the light microscope, they were classified according to their surface morphology using the scanning electron microscope. Some of these stomatocysts were previously described from outcrops in Mors, Jutland or in deep sea deposits from the Norwegian Sea. Two assemblages were recognized in the Expedition 302 sediments; an upper assemblage associated with proxies for the presence of sea ice (i.e., ice rafted debris and sea ice diatoms), and a lower assemblage associated with ice-free conditions. Clumps of stomatocysts strongly resembling fossilized colonies were only observed in sediments related to the Azolla event (49 Ma), when blooms of the freshwater fern Azolla sank to the sea bed. This suggests that some of the stomatocysts may have been produced by freshwater chrysophytes, whereas others distributed either throughout the core or associated with sea ice proxies may have been produced by marine or brackish species.

Presentation

BOEKELOVIA: A NON-CHRYSOPHYTE TAXON WITH A COMPLICATED NOMENCLATURAL HISTORY

Julius, M.¹, Andersen, R. A.²

¹St. Cloud State University, St. Cloud, USA ²Friday Harbor Laboratories, University of Washington, Friday Harbor, USA Suspicions concerning Boekelovia's proper taxonomic and systematic position have persisted for over 30 years. Molecular sequence data (SSU, rbcL, and psbC) have a greater similarity with members of the Prymnesiophyceae, specifically the Pavlovales, the with the Chrysophyceae. This corroborates morphological observation of the taxon, whose triangular shape, flagellar insertion, and plastid composition are similar to Sphaleromantis and Pavlova. Unfortunately, Boekelovia was only provisionally established in its original treatment making the publication invalid. The nomenclatural status of the taxon is presented in an attempt to associate the taxon with its appropriate taxonomic designations. The phylogeny and taxonomy of the Pavlovales is also presented based upon molecular relationships of taxa available from genbank.

Poster

A PRELIMINARY MULTI-GENE PHYLOGENY FOR THE CHRYSOPHYTE ALGAE

Julius, M., Chanthirath, I., Stepanek, J.

St. Cloud State Univeristy, St. Cloud, USA

Unlike other heterokant algae, the monophylly of the synurophytes and chrysophytes has not been obvious to phycologists studying this collection of taxa. A collaborative effort to resolve the evolutionary relationships of heterokont algae is ongoing. A byproduct of this project is a focus on the systematic relationships of synurophyte and chrysophyte taxa. Ultimately, seven genes for 50+ taxa will be used to produce this phylogeny. This study represents a hallmark interval towards this goal. The results for five genes are presented. The phylogeny produced does not support the separation of the chrysophytes and synurophytes as monophyletic taxonomic groups. The synurophytes appear to be a monophyletic clade nested within the large chrysophyte group. Additionally, data suggest the genera Mallomonas and Synura may be paraphyletic rather than monophyletic lineages. The phylogeny also supports other investigations demonstrating that unicellular genera (specifically Chromulina and Ochromonas) are not monophyletic groups, but rather a collection of polyphyletic species scattered throughout the larger chrysophyte clade. Overall,

these results suggest the need for developing a detailed morphological data set useful in reflecting homologous states within the chrysophyte lineages.

Presentation

HYDRURUS IN NATURE AND IN CULTURE: AN OVERVIEW

Klaveness, D.¹, Lindstrøm, E.-A.²

¹Department of Biology, University of Oslo, Oslo, Norway ²NIVA, Oslo, Norway

Research on the large and common winter alga *Hy-drurus foetidus* have lagged behind, compared to the active fields of plankton and paleolimnological research on chrysophytes. An overview and recent progress of *Hydrurus* research will be given, and some ideas on how to proceed (with international participation) will be presented.

Presentation

INVESTIGATION OF THE SYMBIOTIC INTERACTIONS BETWEEN CHLAMYDOMONAS SP. AND VARIOUS BACTERIAL STRAINS

Lakatos, G. E., Keresztúri, K., Horváth, B., <u>Maróti, G.</u>

Bay Zoltán Nonprofit Research Ltd., Szeged, Hungary

The presumed symbiotic interaction between *Chla-mydomonas* sp. and various bacterial strains was investigated in details. The green alga *Chlamydomonas intermedia* MACC-549 has been cultivated in Kuhl liquid medium for decades. During cultivation different types of consortia including *Chlamydomonas intermedia* MACC-549 were established. By plating serial dilutions different non-algal microorganisms were identified as essential members of these microbial communities.

We have investigated the effects of the presence of various combinations of the identified bacteria on the physiological and metabolic properties of the *Chlamydomonas intermedia* MACC-549 algae. Metabolic alterations were monitored using HPLC by measuring acetate, formate, lactate and ethanol in

the microbial communities in line with continuous pH measurements. Using air-tight serum bottles the headspace of the cultures was monitored by gas chromatography, characteristic fluctuations were detected in the level of nitrogen, oxygen and hydrogen for each combination.

Whole transcriptome analyses of the single and symbiotic cultures were performed in order to detect the differential expression of several bacterial and algae genes, therefore to understand the intracellular metabolic processes responsible for the observed specific phenotypes of mixed cultures.

Poster

MORPHOLOGICAL VARIABILITY OF CHRYSOPHYTE CYSTS FROM AN EOCENE MAAR LAKE IN THE CA-NADIAN ARCTIC

Lott, A. M., Siver, P. A.

Department of Botany, Connecticut College, New London, USA

Siliceous microfossils abound in lake sediments deposited in the Giraffe kimberlite diatreme, a Middle Eocene maar lake situated near the Arctic Circle in the Northwest Territories of Canada during the Cenozoic hot house. Overall, this extensive core contains an astonishing diversity of exquisitely preserved siliceous microfossils representing the Chrysophyceae, Synurophyceae and Bacillariophyceae, as well as sponge remains and scales from testate euglyphids and heliozoans. Of the vast array of microfossils, Chrysophyceae and Synurophyceae resting stages known as stomatocysts, or cysts, are by far the most abundant, often accounting for over 50% of all microfossils and dominating much of the 68.3 m of lacustrine facies. To date, we have documented well over 100 different cysts that collectively represent a vast array of morphological structures. We will use remains of ten different cyst types to demonstrate the range in size, cyst wall ornamentation, pore structure and collar development. Although some of the cysts have smooth and unornamented walls as is commonly reported in modern waterbodies, many are highly ornamented with papillae, pores, ridges and spines, and it is clear that cyst development was well established by the Eocene. In modern lacustrine systems, we often do not know which organisms produce many of the cyst types that are observed. Interestingly, in the Giraffe core we can often uncover well developed cysts that still contain parts of the parent cell wall, allowing us to link some cyst types with specific organisms. In the future, we plan to publish an atlas of these Eocene resting stages and use their remains to piece together the history of the waterbody.

Poster

MALLOMONAS PUMILIO GROUP - A REVISION BASED ON THE SCALE/SCALECASE MORPHOLOGY AND GEOMETRIC MORPHOMETRIC DATA

<u>Němcová, Y.</u>, Kreidlová, J., Pusztai, M., Neustupa, J.

Department of Botany, Faculty of Science, Charles University in Prague, Prague, Czech Republic

The species of Mallomonas pumilio group belong to the smallest taxa of the genus (the whole cells reach the length of ca. 12-14 µm). This study is based on 250 silica scales of taxa sampled wordwide. Detailed scale and scalecase morphology was investigated by transmission and scanning electron microscopy and scales were sorted to units representing species and/or varieties. To evaluate the slight differences in scale morphology we used the methods of landmark based geometric morphometrics (GM). Homologous points (landmarks) were delimited to represent maximally the scale shape within each unit. Multivariate statistical procedures were used to test differences in shape between a priori set units. The new species M. jubata was described and characterized. Varieties Mallomonas pumilio var. silvicola and M. pumilio var. munda were erected to the species level M. silvicola and M. munda, respectively. The nominal variety of M. pumilio was specified and the emended definition provided. Mallomonas directa, so far not distinguished from M. pumilio var. pumilio, was separated on the bases of larger scales, different scale morphology and GM data. The new varieties M. pumilio var. dispersa and M. solea-ferrea var. irregulare were introduced. However, molecular data is needed to evaluate whether these taxa should be treated as varieties or separate species. So far, none

of the members of *Mallomonas pumilio* group has been sequenced.

Presentation

NEWLY DESCRIBED SPECIES OF THE GENUS MAL-LOMONAS

Němcová, Y., Pusztai, M., Kreidlová, J.

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Four new recently described species of the genus Mallomonas are introduced. Mallomonas temonis (sectio Heterospinae) was sampled in a small humic pool on the top of the Table Mountain (South Africa). A scale is surrounded by a submarginal rib curving round the dome, crossed by a strong rib in a posterior part. Next three species belong to the sectio Torquatae. The rib pattern of Mallomonas decora (type locality: Pekelsky Pond, Czech Republic) consists of more or less transverse occasionally forked ribs, anterior flanges are covered by conspicuous densely aligned transverse ribs. Mallomonas jubata (type locality: Etang Cazaux, France) represents a pumilio-group member. Collar scales possess a typical helmet like extension, anterior and partly posterior flanges are marked with pores. Both collar and body scales of Mallomonas divida (type locality: a small lake near Le Marais d'Orx, France) have a shield divided by one or several grooves. A dome has a small peak and is partly reticulated by circular meshes. An anterior flange bears several rows of papillae.

Poster

PATTERNS OF MORPHOLOGICAL INTEGRATION IN SCALES OF SYNURA MACRACANTHA AND S. PE-TERSENII CONCUR WITH THEIR DIFFERENT EVOLU-TIONARY AGE

Neustupa, J., Škaloudová, M., Škaloud, P.

Department of Botany, Faculty of Science, Charles University in Prague, Prague, Czech Republic Patterns of morphological integration among various biological structures can be assessed using methods quantifying shape variation based on the geometric morphometric data. The keel and plate of the Synura scales have been considered more or less independent units that merged during the evolution of the genus. In this study, morphological integration of keels and plates of scales was investigated in two different lineages of the Synura petersenii clade. S. macracantha forms a basal lineage of this clade, whereas the species group formed by the closely similar S. americana, S. macropora and S. petersenii sensu stricto (AMP-lineage) evolved much later. Our results, based on the analysis of the asymmetric variation of landmarks depicted on scales, indicated that keels of the AMP-lineage were more integrated with the scale plates than the keels of Synura macracantha. This difference possibly reflected different phylogenetic position of both lineages. Low morphological integration of keels in S. macracantha may be considered a primitive character and suggests a pronounced morphological stasis of S. macracantha scales.

Presentation

TETRAPYRROLE PATHWAY IS SHAPED BY THE PASSED ENDOSYMBIOTIC EVENTS

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Tetrapyrroles (heme and chlorophyll) are compounds essential for life. They have to be synthesized by the organism or obtained from the environment. In general, phototrophic and primarily heterotrophic eukaryotes differ in the synthesis of the first precursor δ - aminolevulinic acid (ALA). Primary heterotrophs form ALA by the C4 pathway in mitochondrion and cytosol respectively. In contrast, eukaryotic phototrophs synthesize ALA from glutamate in C5 pathway entirely located in the plastid. However, several exceptions to this arrangement exist. Although apicomplexan parasites and chromerids synthesize ALA in the mitochondrion using C4 pathway, the rest of the route is localized to the plastid (chromerids) or the last two steps are relocated to the mitochondrion (apicomplexans). Chromerids are therefore unique phototrophs synthesizing chlorophyll from glycine instead of glutamate, as do other phototrophs. In Euglena gracilis, two tetrapyrrole pathways are functioning in the cell; one heterotrophic-like in the cytosol and mitochondrion, while the second one is plastid localized. Similar arrangement was found in chlorarachniophyte Bigelowiella natans. Contrary, cryptophyte Guillardia theta synthesizes tetrapyrroles in the plastid, with two ferrochelatases (the last step of the synthesis) localized in plastid and mitochondrion respectively. We propose that presence of two tetrapyrrole pathways in one cell indicates recent acquisition of the plastid. Since cryptophytes are the only algae with red complex plastid having remnant of the mitochondrial pathway, we propose later acquisition of its plastid when compared to stramenopiles and haptophytes.

Presentation

CHRYSOPHYCEAN STOMATOCYSTS FROM THE GREAT XIAN'AN MOUNTAINS, CHINA

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China has a vast territory with diverse topography and climate. Nonetheless chrysophycean stomatocysts have never been specially studied in China. The Great Xing'an Mountains (118°03'-123°09'E, 43°20′-52°34′N) are located in Northeast China with mean altitude of 1200-1300 meters, formed during the Jurassic orogenesis. This region is characterized by low temperature and high humidity, with a mean annual temperature of -2.8°C and a mean annual precipitation of >500mm. There are many types of aquatic habitats in this area with rich diversity of algae. We collected samples in the Great Xing'an Mountains six times between 2004 and 2011. More than 1000 algae samples were collected from this area and observed with LM. Chrysophycean stomatocysts were observed and photographed with scanning electron microscope from over 240 samples. 220 morphotypes of chrysophycean stomatocysts were identified, of which 160 morphotypes are new to science. Data associated with each morphotype, including sample number, locality, habitat, number of specimens and stomatocysts features were described. These preliminary observations suggest the chrysophycean stomatocysts flora of the Great Xing'an Mountains is both rich and unique. We continue to study this interesting area to further assess its chrysophycean stomatocysts floristic diversity.

Presentation

EFFECT OF TEMPERATURE ON SHAPE AND SIZE OF SYNUROPHYTE SILICA SCALES - A GEOMETRIC MORPHOMETRIC APPROACH

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Temperature belongs to the most important environmental factors affecting planktonic organisms. In this study, geometric morphometric tools were used to investigate the effect of cultivation temperature (5, 10, 15, 20 and 25 °C) on silica scales of 3 species of synurophytes: Mallomonas tonsurata, Synura petersenii and Synura sphagnicola. We showed that size of inorganic silica scales decreases with increasing temperature in agreement with the temperature-size rule which was formulated for the body size of ectotherms. Moreover, also the shape of the scales was significantly affected by the cultivation temperature. The overall shape change from rounded, circular scales to oval or more elongated scales seemed to be a general feature in synurophytes and may be considered a consequence of rising temperature. Furthermore, the difference in shape remained significant even when the effect of size (allometric effect) was separated. Finally, we compared the level of the scales' morphological variation among all temperature treatments. The results indicated that the cultivation temperature of 25 °C negatively affected cellular processes involved in scale biogenesis.

Presentation

SCALE BEARING PLANKTONIC CHRYSOPHYTES FROM NORTH TYROL, AUSTRIA

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Middle Europe belongs to regions with long tradition of chrysophyte research and its flora is in general very well studied. Nevertheless, only very few studies have been published concerning waterbodies within the Alps, European highest mountains. In this study we aimed at the silica-scaled chrysophytes of the Austrian province North Tyrol situated in the northern part of the Alps. During our survey, plankton and upper sediment samples were taken from various lakes and pools. In addition, various environmental parameters were measured. The investigated localities varied considerably both in their chrysophyte flora and physico-chemical characteristics. For example, pH ranged from 5.85 to 8.49 and conductivity from 16 to 673 μScm⁻¹. Altogether, more than 40 taxa were identified in 23 localities, belonging to five different genera -Chrysosphaerella, Mallomonas, Paraphysomonas, Spiniferomonas and Synura. The most abundant species were P. vestita, C. brevispina and M. alpina. To our knowledge, this is the first study of chrysophyte silica scales from the region of North Tyrol based on electron-microscopic observations.

Poster

DIATOM REPRODUCTIVE BIOLOGY AND PHYLOGE-NETIC CONSEQUENCES

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Although we have little idea about the diatom's development among the other heterokont algae and relationships among the major lineages within the diatoms, considerable progress has been made during the last 20 years, particularly in examination of cell structure and sexual reproduction – which are

characteristics previously ignored by most diatomists – and most recently from molecular phylogenetics. Recently published phylogenetic trees suggest that the pennates are monophyletic and evolved from ancestors with centric valve structure. Diatoms are unusual among algae in being diplontic and having a solid bipartite silica frustule. In almost all species the life cycle consists of two principal phases – vegetative division, accompanied by size reduction, and auxosporulation (mostly following sexual reproduction), which results in size restoration. Diatoms differ in many aspects of sexual reproduction, which is in general oogamy in centrics and isogamy in pennates.

Complex organic and/or silica structures are produced by diatoms to protect the expanding auxospores. The isodiametrically expanding auxospores of phylogenetically old lineages of centric diatoms are generally covered by silica scales. By contrast, expansion of most pennate diatoms is bipolar and accompanied by production of perizonia. Recently, scale-like structures have been discovered in the primordial zygote envelope in pennate diatoms, supporting the hypothesis of their phylogeny.

Presentation

CHYSOPHYTE FUNCTIONAL PHYTOPLANKTON GROUPS REVISITED

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For implementation of the WFD in Europe the approaches to standardize ecological quality assessment of phytoplankton in freshwater environments are increasingly based on functional species groups. These are not primarily phylogenetically related taxa but share adaptive features shown by specific pattern in space and time in relation to light, mixing and major nutrient gradients as formulated by Reynolds et al. 2002. Chrysophyte genera were considered within 5 functional groups: 2 typical for the clear water phase in late spring codon X3 dominant taxon *Chrysococcus* (shallow clear mixed layers with low base status) and X2 *Chrysochromulina* (shallow clear mixed layer in meso-eutrophic lakes), one group from the onset of summer stratification E

Dinobryon, Mallomonas (small oligotrophic basepoor lakes, oligotrophic) and 2 groups from midsummer climax U Uroglena (epilimnia stratified lakes, low nutrients) and W2 Synura (small organic ponds). It remains questionable if (A) this approach represents the most relevant Chrysophyte niches in European lakes, (B) the generic approach is sufficient for the optimum ecological validation, (C) the functional groups react identical for the whole spectrum of lakes (from ponds to shallow lakes, small to large dimictic lakes) and large rivers across Europe. Suggestions to improve this approach will be made based on data from classical long-term studies of lakes and bioregional taxonomic assessments.

Presentation

SPECIES COMPOSITION OF CHRYSOPHYTES IN THE WATER BODIES OF PROTECTED AREAS OF THE NORTH-WEST OF RUSSIA

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The ecological status of chrysophytes in freshwater ecosystems is considerable (Kristiansen, 1995). Species composition of these algae is still unknown in many water bodies of Russia. The first investigations of chrysophytes in the waterbodies of three protected areas in the North-West of Russia showed a relatively diverse and abundant flora, including 40 taxa from genera Paraphysomonas, Dinobryon, Pseudokephyrion, Mallomonas and Synura. The majority of the taxa are widely distributed and typical for temperate regions. All taxa are new records for the areas and two species are new to Russia: Mallomonas asmundiae and M. pseudocratis. There were found rather rare species: Dinobryon suecicum, Mallomonas corcontica, M. multiunca. The most frequently distributed species were Dinobryon bavaricum, Paraphysomonas vestita, Synura petersenii f. petersenii, S. petersenii f. kufferathii and S. sphagnicola. In addition 15 different stomatocyst morphotypes were observed in the bodies. Effects of environmental factors on the biodiversity and distribution of chrysophytes in various water bodies of the protected areas are discussed.

NEW INSIGHTS INTO COLOURLESS SCALY CHRYSO-PHYTE TAXONOMY; 'BUTCHERING' THE SPECIES-RICH AND MORPHOLOGICALLY DIVERSE *PARAPHY-SOMONAS* TO MAKE THREE NEW GENERA, *CLATHROMONAS, ACANTHOMONAS* AND *PATEL-LOMONAS*

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Protist taxonomy has been helped and sometimes hindered by the scaly genera. Their scales come in many different shapes, sizes and numbers on different species and have been useful for distinguishing what would otherwise be very similar-looking cells/species. Even before sequencing methods electron microscopy has shown us more diversity among the scaly protists than we ever could have imagined. Previously, however, taxonomists had lumped five different scale types in the single genus Paraphysomonas with ~56 species. To investigate diversity more thoroughly in this genus we cultured 59 isolates, sequenced their 18S rDNA, and studied scales ultrastructurally. We describe 32 new spinescaled species; previously there were only 9, most of which were lumped in two species (P. vestita and imperforata) which we show are broad morphotypes including many extremely genetically diverse species. We observed distinct congruencies between genetics and morphology that were helpful in seeing patterns: the detailed structure of spines and scale base plates distinguishes four major clades with nail-like spine scales. We restrict the genus Paraphysomonas to species with nail-like scales and establish the genus Clathromonas for those with meshwork scales (often dimorphic). We establish Patellomonas for former with non-spiny plate scales and Acanthomonas for those with thorn-like scales.

Presentation

DO SCALED CHRYSOPHYTES HAVE A BIOGEOGRA-PHY? EVIDENCE FROM NORTH AMERICA

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According to the ubiquity hypothesis, eukaryotic microbial species the size of scaled chrysophytes should be globally dispersed (everything is everywhere), with active populations maintained wherever there are habitats that will support growth and reproduction (the environment selects). Assuming there are highly effective vectors that can move cells to new locations, and that suitable habitats are available globally, the ubiquity hypothesis would predict that scaled chrysophytes should lack distinct biogeographic patterns. In contrast, others have argued that scaled chrysophytes have distinct patterns and questioned the ubiquity hypothesis with regard to these organisms. In this study, the distribution of scaled chrysophytes in fresh waters along 3,200 km of the east coast of North America (29º to 48º N) were assessed to determine biogeographic patterns in relation to chemical, physical, climatic and spatial variables. Scaled chrysophytes were identified and enumerated from 264 waterbodies from nine regions (20 subregions) along coastal North America, and eighteen environmental variables were determined for each waterbody. Significant differences in the flora were found between all regions and most subregions, and between glaciated and non-glaciated areas. Significant differences were also recorded between waterbodies with similar chemical and physical characteristics, but situated in different regions. Many species were abundant along specific sections of the latitudinal gradient, but lacking from others. A set of environmental variables explained significant and independent portions of the variation in scaled chrysophytes, with pH and mean minimum July temperature accounting for 20% of the total. In summary, the distribution of scaled chrysophytes along the east coast of North America is not homogeneous and there are biogeographic patterns, despite apparent dispersal mechanisms (migratory birds and wind events) that might act to reduce differences between regions.

Presentation

EXAMINATION OF SCALE SHAPE IN *MALLOMONAS INSIGNIS* USING GEOMETRIC MORPHOMETRICS: EVIDENCE FOR EVOLUTIONARY STASIS IN SCALE ULTRASTRUCTURE

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Mallomonas insignis is a modern synurophyte with a cosmopolitan distribution. It differs from the vast majority of species within the genus because it has two types of spine-bearing scales and lacks the siliceous structure known as a bristle. Recently, scales that look virtually identical to those found on modern cells were uncovered from 40 million year old Eocene deposits. In this study, the shapes of M. insignis scales representing modern and fossil populations were examined using geometric morphometric analysis. A total of 350 scales from ten modern and eight fossil assemblages were analyzed, including three from North America, two from Asia, five from Europe, and eight sections from the Giraffe Pipe sediment core. The modern collections included specimens from three clones. The distribution of fossil scale shapes for M. insignis, as depicted in a relative warp analysis, was largely contained within the shape space represented by modern specimens, and the shape of the fossil specimens was not significantly different from modern collections from France, Sweden and multiple North American sites. This confirms the earlier reports of long-term evolutionary stasis of scale structure in this synurophyte species. Interestingly, there was no difference in the variability in scale shape measured within a single clone, as estimated by Procrustes distances, from that for all modern, all fossil or a combination of modern and fossil specimens. This implies that for *M. insignis* the variation in scale shape on a single cell can be as high as that found within an entire population or even multiple populations from different geographic regions, and that position on the cell covering is a primary source of shape variation within the synurophytes.

Presentation

A SUMMARY OF SYNURA TAXA IN EARLY CENOZO-IC DEPOSITS FROM NORTHERN CANADA

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Five species of fossil Synura are documented from two freshwater Arctic localities, one known as Giraffe Pipe that existed during the Eocene and the other known as Wombat that existed during the Paleocene. Both of these ancient waterbodies existed during the warm Cenozoic hot house when global temperatures were significantly higher than those experienced today. The fossils represent the oldest known remains of Synura and in each case the specimens were easily assigned to the genus. Two of the taxa, Synura recurvata Siver & Wolfe and S. cronbergiae Siver, represent species that are presumably extinct, but can still be linked to modern congeners. A third species may represent a new taxon within the Synura petersenii complex. The last two taxa have scales that are essentially identical to those produced by the modern species S. nygaardii and S. macracantha, although fossil scales of the latter species were significantly larger than modern specimens. Evolutionary stasis in scale ultrastructure evident in these Synura taxa will be discussed in relation to other eukaryote microbes. Based on these findings, the two major sections of the genus, Sectio Synura and Sectio Petersenianae, were well established by the early Cenozoic.

Presentation

TRACING THE EVOLUTION AND SPECIES DIVERSIFI-CATION RATES WITHIN THE GENUS *SYNURA* (SRAMENOPILES)

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Synura represents a common freshwater genus of silica-scaled chrysophytes. Despite its broad occur-

rence, the evolutionary relationships among particular species are still poorly known. In the first part of our contribution, we will present the SSU rDNA and rbcL phylogenetic analyses of Synurophyceae, based on the improved datasets including 8 newly isolated, relatively rare Synura taxa. The SSU rDNA and rbcL phylogenies were highly incongruent, the latter even recognizing the genera Synura and Mallomonas as paraphyletic lineages. In addition, the analyses recovered the significant relationship of S. lapponica to Tessellaria volvocina, a rare Australian endemic species. In the second part of the contribution, we will focus on the cryptic speciation within the morphologically circumscribed, nominal species of Synura. A high level of cryptic diversity was revealed within S. petersenii. The molecular analyses of a number of newly isolated strains strongly indicated the existence of more than 10 cryptic species. The observed genetic diversity within the other Synura species is much lower, though some level of cryptic speciation was detected in S. mammillosa, S. sphagnicola and S. uvella. Moreover, the striking population-level genetic differentiation was detected within S. petersenii s.str. and S. glabra.

Presentation

WWW.CHRYSOPHYTES.EU - DISTRIBUTION AND ECOLOGY OF SILICA-SCALED CHRYSOPHYTES IN EUROPE

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Members of the silica-scaled chrysophytes are an important part of the freshwater phytoplankton. Knowledge of the chrysophyte occurrence and their ecological ranges can be useful for many types of studies, for example for monitoring of the water quality or for paleolimnological and biogeographical studies. An internet database of the European silicascaled chrysophytes has been developed to store the microphotographs and the sampling data (including the geographical coordinates, temperature, pH, and conductivity values), and to provide access to data to all people interested. By this time the database includes data from almost 170 published papers and holds information about the distribution and ecology of 200 species, based on 6500 entries. For each species listed in the database, the photo gallery, list of all records, and the distribution map are provided, and automatically updated with a new entry. For those species having more than 20 records, the distribution frequencies along the pH, conductivity, and temperature gradients are shown, as well. Continual addition of newly published or so far unpublished data is planned. Join us and insert your own records or EM photographs from Europe to the database!

Presentation

SYNUROPHYTES IN THE LAKES AND PONDS OF KENMIN-NO-MORI, YAMAGATA, JAPAN

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The synurophytes from 10 lakes and ponds in Kenmin-no-mori, Yamagata, Japan, were collected between May and July 2011 and identified using light and scanning electron microscopy. These included 4 species of Synura (S. glabra, S. petersenii, S. sphagnicola, S. spinosa) and 16 species of Mallomonas (M. akrokomos, M. caudata, M. crassisquama, M. elongata, M. eoa, M. flora, M. harrisiae, M. heterospina, M. insignis, M. leboimei, M. lelymene, M. matvienkoae, M. papillosa, M. punctifera, M. splendens, M. tonsurata). Two species (S. petersenii, S. sphagnicola) of Synura and 2 species of Mallomonas (M. caudata, M. crassisquama) were found in 6 and 7 of the ponds, respectively. On the other hand, 5 species (S. spinosa, M. insignis, M. heterospina, M. leboimei, M. papillosa) were found only in one lake or pond. Mallomonas leboimei, which was previously found in Europe and North America, has now been observed in Kenmin-nomori, so may be distributed throughout the Northern Hemisphere. The genus Mallomonas was present in all of the lakes and ponds of Kenmin-nomori, whereas *Synura* was absent in two of the lakes, including Lake Arenuma which is characterized by *Dinobryon* blooms and was sampled on ten separate occasions.

Poster

DNA BARCODING: A CASE STUDY IN THE DIATOM GENUS *FRUSTULIA*

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DNA barcoding initiative aims to facilitate identification and discovery of species by the means of molecular methods. Considering relative speed and declining cost of DNA sequencing this approach seems to be promising for both basic research and applied fields that rely on correct species determination. However, even though DNA barcoding has proved feasible for well-studied groups, limited state of knowledge in others currently hinders its advance. This problem is especially striking in many protist groups where, despite their undoubtedly ecological and economic importance, the current level of knowledge greatly lags behind. Presented study examined candidate markers for barcoding in diatoms (nuclear D1-D2 LSU rDNA and V4 SSU DNA, mitochondrial COI-5P, and plastidial rbcL-3P) in the genus Frustulia. In order to judge universality and power of selected markers, both distantly related Frustulia species and sister lineages of the species complex F. rhomboides were included in the study. Even though our results support currently prioritized choice of dual barcode consisting of rbcL-3P and partial LSU rDNA, all markers examined were considered suboptimal from some reason. Encountered problems have thus pointed out the need for deeper understanding of speciation and dispersal of diatoms and other protists.

Presentation

A NEW SPECIES OF *SYNURA* FROM GENHE, INNER MONGOLIA, CHINA

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The scales and stomatocysts collected from a *Sphagnum* bog in Genhe, Inner Mongolia, China (122°23'E, 51°06'N) were observed using light, scanning, and transmission electron microscopy. A new species of *Synura*, *Synura morofera* nom. prov., was found. This *Synura* has two scale types on the same cell: spineless body scales and spine-bearing body scales. The colony is large and oblong in shape, and was found stomatocysts in it. The stomatocyst of *Synura morofera* is named Stomatocyst 55, Pang, W. & Q. Wang, which is new to science also.

Poster

CHRYSOPHYCEAN STOMATOCYSTS FROM THE STONE PONDS IN THE AERSHAN NATIONAL GEO-LOGICAL PARK, CHINA

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Stone Ponds formed by late Mesozoic volcanic eruptions are scattered in the Aershan National Geological Park, Inner Mongolia, China (119°28'E-121°23'E, 46°39'N-47°39'N). This area is the largest basalt landform of extinct volcanoes in Asia. Source water of the Stone Ponds is derived mainly from underground springs, and has great transparency. Water pH values range from 6.4 to 8.4, and temperature of most ponds is lower than 10°C. A total of 20 stomatocysts morphotypes was observed with scanning electron microscopy, of which 13 are new to science. This is the first report of chrysophycean stomatocyst from such a unique habitat. The relationship between the stomatocyst assemblages and physical, chemical and biological parameters such as diatoms and other filamentous algae were discussed. Most of the stomatocysts in the Stone Ponds prefers the cool and neutral to weakly acidic water. Stomatocyst 22, Pang, W. & Q. Wang, Stomatocyst 296, Gilbert & Smol and Stomatocyst 79, Van de Vijver, B. & Beyens, L. are relatively abundant in the Stone Ponds.

STUDIES ON SILICA-SCALED CHRYSOPHYTES FROM THE DAXINGANLING MOUNTAINS AND WUDALI-ANCHI LAKE REGIONS, CHINA

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From July 11 to 22, 2009 and on August 6, 2011 twenty one phytoplankton samples containing chrysophytes were collected in Daxinganling Mountains and Wudalianchi Lake Regions located in Northeast China. Forty one species and four forms of silica-scaled chrysophytes have been identified by means of transmission electron microscopy, nine of them belonging to Chrysophyceae and thirty-six to Synurophyceae. *Chrysophaerella longispina*, *Spiniferomonas abei, Paraphysomonas eiffellii, Mallomonas maculata, M. lelymene, M. pumilio, M. eoa, M. torquata, Synura lapponica, S. petersenii* f. *kufferathii, S. petersenii* f. *bjoerkii* are reported for the first time from China.

In this study the most species discovered were common and widely distributed in the world. Among them, Spiniferomonas trioralis, Paraphysomonas vestita, Mallomonas papillosa, M. striata, M. tonsurata, M. crassisquama, Synura uvella, S. echinulata, S. petersenii, S. petersenii f. kufferathii were observed in 30 % of water bodies studied, including ponds, lakes, reservoirs, streams, marshes, swamps, and over a very wide pH range and temperature conditions. Some species, such as Mallomonas lelymene and M. insignis are scattered but widely distributed in the world. M. maculata is scattered in the world. However, Chrysosphaerella longispina, M. punctifera, M. multiunca, M. torquata, Synura lapponica, S. petersenii f. bjoerkii are distributed in the temperature regions of the Northern Hemisphere. M. corymbosa and M. pumilio are distributed in the temperate regions of the Northern and Southern Hemisphere. In this study the sampled localities were situated at the 46°36'-53°33'N, 119°28'-127°53'E. It is evident that the silica-scaled chrysophyte flora in this region has a definite temperate element.

Presentation

STUDIES ON SILICA-SCALED CHRYSOPHYTES FROM ZHEJIANG, JIANGSU AND JIANGXI PROVINCES, CHINA

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Twenty five phytoplankton samples containing chrysophytes were collected in Zhejiang, Jiangsu and Jiangxi Provinces located in Eastern China between April, 17 and December 19, 2011. Forty five species, one variety and four forms of silica-scaled chrysophytes have been identified by means of TEM, eleven of them belonging to Chrysophyceae and thirty nine to Synurophyceae. Spiniferomonas silverensis, S. bilacunosa, Mallomonas paxillata, M. splendens, M. harrisiae, M. koreana, M. acaroides var. obtusa, Chrysodidymus synuroideus are reported for the first time from China. Mallomonas alveolata f. protuberans Wei f. nov. is new to science. In this study the most species discovered are cosmopolitan or wide distributed in the world. Some species, such as Mallomonas splendens, M. insignis and M. grata are scattered, M. oviformis and M. punctifera are distributed in the temperate regions of the Northern Hemisphere. M. corymbosa is distributed in the temperate regions of the Northern and Southern Hemispheres. Chrysosphaerella annulata, M. peroneides and M. portae-ferreae are cosmopolitan or widely distributed but mainly distributed in tropical or subtropical regions or during a warmer season in temperate zones. Mallomonas harrisiae, M. koreana and M. acaroides var. obtusa have been reported only from the neighboring countries, such as Japan or Korea. Sampled water bodies were situated in eastern China. So that in this region the silica-scaled chrysophyte flora has a definite East Asia element.

Poster

SEX, CYSTS, AND LOCAL ADAPTATION IN FRESHWA-TER PROTISTS

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In spite of early observations of ciliate sexuality in the late 17th century and its enormous theoretical and practical significance, the occurrence and actual frequency of sex is unknown in >99% of all natural, extant protist taxa including chrysophytes. Several protist lineages with closely related facultative sexual and obligatory asexual species are ideal model organisms to assess the relative fitness advantage of sexual recombination/reproduction. The timing of sex appears to be crucial for the adaptive response of the population. It is the combination of sexual recombination and asexual (clonal) reproduction that is very powerful to generate local adaptation. Cyst formation is an adaptation in the life cycle of chrysophytes and many other protists enabling a population to survive periods of unfavorable ambient conditions. Upon the return to the initial or otherwise favorable conditions, excysting specimens may have increased their fitness, because the genes of non-encysting conspecifics may have been lost in the population. However, since the genetic make-up of the excysted cells remained, at best, unchanged, encystment/excystment does not lead to a better adaptation to the local conditions. I conclude that there is an important conceptual difference between sex and cyst formation in the life cycle of a protist species.

Presentation

QUANTIFICATION OF MORPHOLOGICAL CHANGES DURING THE LIFE CYCLE OF DIATOMS

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The diatom frustules bear important morphological characters for determining diatom species. However, the morphological identification of species is complicated by size diminution of diatom silica cell walls during the vegetative phase of the life cycle. Although the size reduction of diatom cells is a generally known phenomenon, there are few studies investigating quantitatively the allometric shape variation of frustules. In this study, we examined the shape changes of a monoclonal population cultivated in stable conditions using landmark methods of geometric morphometrics. We were interested in

variation of asymmetry, complexity, allometry, and disparity that is associated with vegetative division. Three homothallic strains of different diatom genera were cultivated for more than three years in order to document the whole diatom life cycle. Results show that there are significant allometric shape changes of frustules during the vegetative phase of the life cycle. Phenotypic variability in monoclonal populations is an interesting finding from an evolutionary point of view. It may indicate developmental constraints caused by rigid silica cell wall because the cells that undergo several mitotic divisions have to deal with changes of surface to volume ratio as well as with the possible errors during cell wall synthesis.

Presentation

EUKARYOTIC ALGAE AND ECOSYSTEM DYNAMICS

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Half of global primary production is performed in the marine biosphere. A diverse array of phytoplankton taxa is responsible for this photosynthetic CO₂ uptake. Among the most abundant marine phytoplankton are small unicellular eukaryotes referred to as pico- and nano-eukaryotes. Community changes resulting from atmospheric and sea surface warming appear to already be underway, with increasing numbers of pico-eukaryotes being observed in the Arctic, while larger cell appear to be in decline. However, our understanding of the physiology and evolutionary history of many environmentally relevant taxa is still limited - although unicellular eukaryotes have been understudy for many years, others are still being discovered and many remain uncultured. Furthermore, what was once presented as a simple picture of "photoautotrophy" in ecosystem models and marine food webs is increasingly being scrutinized as mixotrophs gain more attention. Integrated genomic analyses that involve working with both cultured isolates and 'wild' uncultured populations are a powerful way to investigate these important organisms. Here, new approaches for studying unicellular eukaryotes, including marine chrysophytes, and resulting insights on their evolution, diversity and physiology will be discussed.

Presentation

PHYLOGENY OF PHOTOSYNTHETIC HETEROKONT ALGAE

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While the monophyly of individual heterokont algal classes has been consistently recovered with molecular data, the phylogenetic relationships among the heterokont algae remained unresolved. We recently reported a reasonably supported phylogenetic tree using five-gene data (nuclear encoded SSU rRNA; plastid encoded rbcL, psaA, psbA, psbC) based upon 89 taxa representing all 16 heterokont classes. In that study, the heterokont algae formed three clades, which we labeled SI, SII, and SIII. Here, we present an updated seven-gene phylogeny by adding the atpB and psaB genes. Individual trees for both new genes were consistent, and the three major clades were clearly recognized. The Aurearenophyceae, Chrysomerophyceae, Phaeophyceae, Phaeothamniophyceae, Raphidophyceae, Schizocladiophyceae and Xanthophyceae formed the SI clade. The Chrysophyceae, Eustigmatophyceae, Pinguiophyceae, Synchromophyceae and Synurophyceae formed the SII clade. The Bacillariophyceae, Bolidophyceae, Dictyochophyceae and Pelagophyceae formed the SIII clade. In this symposium, we will discuss alternative hypotheses, morphological and biochemical features, and codon usage bias found in certain taxa.

PHYTOPLANKTON PIGMENT PARTITIONING IN SHELF WATERS OF THE OLIGOTROPHIC NORTH EASTERN MEDITERRANEAN – CONTRIBUTION OF 19'-BUTANOYLOXYFUCOXANTHIN TO THE BULK

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Phytoplankton pigment composition was analyzed monthly over the period May 2010 - October 2011 to determine changes in phytoplankton group assemblages using HPLC at two shelf stations in the Cilician basin (northeastern Mediterranean). Total seven major pigment types namely fucoxanthin (diatoms), 19'-hexonoloyxyfucoxanthin (prymnesiophytes), peridinin (dinoflagellates), chlorophyll-b (chlorophytes), zeaxanthin (cyanobacteria), 19'butanoyloxyfucoxanthin (chrysophytes), divinyl chlorophyll-a (prochlorophytes) were used to define phytoplankton groups present in the area. Shallower shelf station with a total depth of 40 m was dominated by diatoms during winter & spring and then replaced by cyanobacteria during summer & autumn, over the year. Conversely, prokaryotic picoplankton (cyanobacteria and prochlorophytes) dominated the flora followed by prymnesiophytes at the deeper station situated at the shelf edge.

Concentrations of 19'-Butanoyloxyfucoxanthin varied between almost below the detection limits and maximum 90 ng l⁻¹ in shelf waters. The highest concentration was met at 100 m in the deeper station during October, 2010. On average, contribution of 19'-Butanoyloxyfucoxanthin to the total chlorophyll remained below 9% at the deeper station and below 5% at the shallower one excluding the peak concentrations obtained in May 2010, in the latter. Concentrations tend to increase with depth at the deeper station during summer & autumn period. Highly significant positive correlation was found between 19'-Butanoyloxyfucoxanthin concentration and nitrite+nitrate and depth and a highly significant negative one with temperature at both stations.

Presentation

Presentation

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