LÍVIA FRANCO DA COSTA

Taxonomia e ecologia de *Eunotia* (Bacillariophyceae) em represas das regiões Sul e Sudeste do Estado de São Paulo

Dissertação apresentada ao Instituto de Botânica da Secretaria do Meio Ambiente, como parte dos requisitos exigidos para a obtenção do título de MESTRE em BIODIVERSIDADE VEGETAL E MEIO AMBIENTE, na Área de Concentração de Plantas Avasculares e Fungos em Análises Ambientais.

SÃO PAULO
2015

LÍVIA FRANCO DA COSTA

Taxonomia e ecologia de *Eunotia* (Bacillariophyceae) em represas das regiões Sul e Sudeste do Estado de São Paulo

Dissertação apresentada ao Instituto de Botânica da Secretaria do Meio Ambiente, como parte dos requisitos exigidos para a obtenção do título de MESTRE em BIODIVERSIDADE VEGETAL E MEIO AMBIENTE, na Área de Concentração de Plantas Avasculares e Fungos em Análises Ambientais.

Orientadora: Profª Drª DENISE DE CAMPOS BICUDO

Ficha Catalográfica elaborada pelo **NÚCLEO DE BIBLIOTECA E MEMÓRIA**

Costa, Lívia Franco da
C837t Taxonomia e ecologia de *Eunotia* (Bacillariophyceae) em represas das regiões Sul e Sudeste do Estado de São Paulo / Lívia Franco da Costa -- São Paulo, 2015.
348p. il.

Dissertação (Mestrado) -- Instituto de Botânica da Secretaria de Estado do Meio Ambiente, 2015.
Bibliografia.

1. Diatomáceas. 2. Preferência ecológica. 3. Sedimentos superficiais. I. Título.

CDU: 582.26

“Sei que às vezes uso palavras repetidas, mas quais são as palavras que nunca são ditas?”

Renato Russo

Ao meu filho, Gustavo, por toda luz que traz à minha vida.
Aos meus pais, Alexandre e Rita, pelo incentivo
e apoio a todas minhas realizações.
Dedico.

AGRADECIMENTOS

À minha orientadora, Profª Drª Denise de Campos Bicudo, por ter me recebido de braços abertos como aluna, ainda na graduação, estando presente e contribuindo desde o início da minha formação científica. Obrigada por todo apoio e incentivo, pelas oportunidades, cobranças e enorme paciência, pelo conhecimento doado e principalmente por acreditar e confiar no meu trabalho.

Ao Prof. Dr. Carlos E. de M. Bicudo, agradeço por todo o carinho, por compartilhar conhecimentos e experiências, tanto profissionais quanto pessoais. É uma grande honra poder conviver com você.

Ao Dr. Carlos E. Wetzel, por toda a ajuda, desde a resolução das dúvidas mais simples às horas destinadas à microscopia eletrônica de varredura. Mas principalmente, agradeço pela amizade.

Ao Prof. Luc Ector, pela confiança e oportunidade de realizarmos esse trabalho conjuntamente, pelos inúmeros e-mails de valiosas correções, literatura e mesmo cobranças. Também, por possibilitar o estágio no LIST (Luxembourg Institute of Science and Tchnology), que trouxe tanta contribuição a esse trabalho.

À Drª Sandra Costa-Böddeker por me apresentar às diatomáceas e possibilitar a minha entrada para esse mundo.

Ao Prof. Dr. Eduardo Morales, pela grande contribuição ao meu entendimento em taxonomia de diatomáceas por meio da participação em suas aulas em visitas ao país.

À Drª Carla Ferragut e ao "Povo das Águas" agradeço pela inestimável colaboração dentro do laboratório de ecologia aquática e da microscopia, além do conhecimento e da companhia compartilhados: obrigada Simone Wengrat, Ana Margarita, Stéfano Zorzal, Stefania Biolo, Krysna Morais, Jennifer Paola, Gisele Marquardt, Elaine Bartozek, Simone Oliveira, Lucineide Santana, Samantha Faustino, Thiago dos Santos, Carolina Destito, Gabrielle Araujo, Maria Auxiliadora Pinto, Mayara Casartelli, Pryscilla Almeida. Também aos que já fizeram parte e seguiram seus caminhos: obrigada, Angélica Riguetti, Barbara Pellegrini, Jeniffer Pereira, Karine Rivelino, Larissa Stevanato, Luciane Fontana, Mariane de Souza e Majoi Nacimento.

Ao Stéfano Zorzal, por sempre me salvar, principalmente com tudo que envolvia números. À Simone Wengrat, pelos conselhos e ouvidos disponíveis para tantas reclamações.

Ao Yukio Hayashi, por toda a disponibilidade em ajudar com documentos e computadores.

Ao Prof. William de Queiróz, do Laboratório Geoprocessamento da Universidade de Guarulhos, pela ilustração da área de estudo.

A CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) por permitir a realização desse trabalho através do apoio financeiro com a bolsa de mestrado concedida inicialmente. À FAPESP (Fundação de Amparo à Pesquisa no Estado de São Paulo) pelo apoio financeiro concedido para continuação e finalização desse trabalho mediante concessão da bolsa de mestrado (Processo 2014/15109-0) e da bolsa de estágio no exterior (BEPE, Processo 2014/25311-1). Agradeço, ainda, pelo inestimável apoio recebido pelo projeto temático AcquaSed (FAPESP processo 2009/53898-9) ao qual esta dissertação está vinculada e que forneceu o banco de dados limnológicos e as amostras para a realização deste estudo.

Àqueles que participaram de forma menos direta, mas que fizeram a maior diferença. Ao meu anjinho, Gustavo, por ser minha maior motivação para lutar por qualquer objetivo, por sempre me fazer ver amor em tudo. Aos meus pais, Rita e Alexandre, por serem os melhores exemplos e os maiores colaboradores do dia a dia, por toda a dedicação com minha educação e futuro. Aos meus irmãos, Ciça e Lucas, pela nada fácil convivência diária. Aos amores da minha vida, Stephany, Marie e Rafael por sempre aguentarem o chororô infindável, obrigada, vocês fazem com que eu me sinta uma pessoa de muita sorte. Ainda, aos queridos Luiz, Rodrigo, Bruno, Krysna, Karina e Stefania pela amizade e apoio a qualquer momento. Sou muito grata.

A todos aqueles que de alguma forma contribuíram, muito obrigada!

SUMÁRIO

RESUMO

Eunotia Ehrenberg representa um dos maiores gêneros de diatomáceas existentes, caracterizando-se principalmente pela rafe curta restrita aos polos e pela presença de rimopórtula. No Estado de São Paulo, estima-se que ao redor de 90 espécies/variedades de *Eunotia* sejam conhecidas. Todavia, a maior parte das informações não foi publicada. Ainda, informações ecológicas sobre a distribuição das espécies deste gênero no país são praticamente inexistentes. Desta forma, esse trabalho visou ampliar o conhecimento taxonômico e ecológico do gênero com base no estudo de populações encontradas em 32 represas, distribuídas em cinco bacias hidrográficas das regiões sul e sudeste do Estado de São Paulo. O material estudado incluiu 225 lâminas permanentes, abrangendo amostras de distintos hábitats (planctônicas, perifíticas e de sedimentos superficiais), épocas do ano (verão/inverno) e profundidades (local mais profundo e raso). O levantamento taxonômico foi feito a partir da análise detalhada das populações encontradas em microscopia de luz e eletrônica de varredura. A delimitação das populações levou em conta a circunscrição de materiais-tipo disponíveis em literatura. O avanço ecológico sobre as preferências ecológicas das espécies/variedades foi feito a partir da associação da distribuição quantitativa (abundância relativa) dos táxons com variáveis limnológicas (pH, condutividade, fósforo e nitrogênio total) disponíveis no banco de dados do projeto maior em que se insere essa pesquisa (projeto AcquaSed). Para tanto foram consideradas apenas espécies que tiveram frequência de ocorrência ≥ 10% em determinado hábitat. Com isso, foram identificados 85 táxons específicos e infraespecíficos de *Eunotia* para a área de estudo, dentre eles 11 foram considerados espécies novas e 13 foram reportados pioneiramente para o país. Todos os táxons foram medidos, discutidos e ilustrados em microscopia de luz e eletrônica sempre que possível. A comunidade dos sedimentos superficiais apresentou-se como a mais diversa, seguida do perifíton e fitoplâncton. O ótimo ecológico foi calculado para 19 espécies, confirmando a preferência ecológica de *Eunotia* por ambientes oligo/mesotróficos, ácidos a levemente ácidos e de baixa condutividade, contudo é documentada pela primeira vez a preferência de duas espécies por condições mais degradadas.

Palavras-chave: diatomáceas, fitoplâncton, perifíton, preferência ecológica, sedimentos superficiais

ABSTRACT

Eunotia Ehrenberg is one of the largest existing diatoms genera, mainly characterized by short raphe restricted to the poles and the presence of rimoportula. In São Paulo State, it is estimated that around 90 species/varieties of *Eunotia* are known. However, most information is not published. Besides, ecological information on the distribution of species of this genus are almost inexistent in the country. The objective of this work is to improve understanding of the taxonomy and ecology of the genus based on the study of populations found in 32 reservoirs, distributed in five river basins of south and southeast regions of the state of São Paulo. The material studied included 225 permanent slides covering different habitats (plankton, periphyton and surface sediments), seasons (summer/winter) and depths (deeper and shallow site). The taxonomic survey was based on the detailed analysis of the populations found in light and scanning electron microscopy. The delimitation of the populations considered the circumscription of type materials available in literature. The ecological preferences of the species/varieties were made from the association of their relative abundances with limnological variables (pH, conductivity, total phosphorus and nitrogen) available in the database of the AcquaSed project. Therefore, we considered the species that have frequency of occurrence ≥ 10% in a given habitat. We identified 85 specific and infraspecific taxa of *Eunotia*, including 11 new species and 13 first reported species for Brazil. All taxa were measured, discussed and illustrated in light and electron microscopy whenever possible. The community of surface sediments was the most diverse, followed by periphyton and phytoplankton. The ecological optimum was calculated for 19 species, confirming the ecological preference of *Eunotia* by oligo/mesotrophic, acidic to slightly acidic and low conductivity environments, however is documented for the first time the preference of two species by degraded conditions.

Key words: diatoms, ecological preferences, periphyton, phytoplankton, surface sediments

1. INTRODUÇÃO

As diatomáceas são organismos microscópicos unicelulares, eucariontes e fotossintéticos, que apareceram no período Jurássico há 200 milhões de anos (Metzeltin & García-Rodríguez 2003). Seu conteúdo protoplasmático está inserido dentro de uma parede celular, ou frústula, impregnada por sílica. A frústula é dividida em duas partes maiores conhecidas como valvas, as quais são unidas por várias estruturas estreitas que formam o cíngulo (Round *et al*. 1990). A identificação desse grupo de algas é baseada na morfologia de suas frústulas as quais exibem padrões espécie-específicos (Berzano *et al*. 2012).

Tais organismos formam o grupo mais especioso de algas e apresentam grande importância ecológica nos ciclos do carbono, da sílica (Chepurnov *et al*. 2004), bem como na bioindicação de alterações ambientais recentes e pretéritas (Smol 2008). Até o momento, foram descritas cerca de 12.000 espécies, sendo reportados mais de 250 gêneros vivos (Morales *et al*. 2009). Estimativas do número de espécies diferem conforme os autores, mas a maioria indica que o número total excede 200.000 espécies (fósseis e recentes) e que ao redor de 50-100 espécies novas sejam publicadas a cada ano a partir de estudos comparados de microscopia fotônica e eletrônica de varredura (Fourtanier & Kociolek 2003, Williams & Reid 2006a).

Devido a sua parede celular característica e ampla distribuição global, as diatomáceas têm atraído o interesse de naturalistas e pesquisadores desde o século 18, no entanto, o valor desses organismos em pesquisas ecológicas e paleoambientais tornou-se amplamente reconhecido no século 20 (Flower 2005). Assim, nas últimas três décadas, a taxonomia do grupo sofreu grande mudança, tanto pelo aumento da preocupação com a biodiversidade global, como, principalmente, pelo uso da microscopia eletrônica de varredura e utilização crescente das diatomáceas na bioindicação e para decifrar vários aspectos da história do planeta (Smol & Stoermer 2010).

Dentre as diatomáceas, as eunotióides apresentam alguns dos mais importantes exemplos de indicadores de valor ecológico, diversificação, biogeografia e endemismo (Edlund & Brant 2010), apresentando também grande importância nas áreas da sistemática e filogenética, com a aparente posição de transição do gênero *Eunotia* Ehrenberg entre as diatomáceas penadas rafídeas e arrafídeas (Williams & Reid 2006b).

Eunotia é o gênero mais representativo da Família Eunotiaceae, pertencente à Ordem Eunotiales e Subclasse Eunotiophycideae. Os demais gêneros incluídos nesta família são *Actinella* F.W. Lewis, *Amphorotia* D.M. Williams & G. Reid, *Colliculoamphora* D.M. Williams & G. Reid, *Desmogonium* Ehrenberg in Schomburgk, *Eunophora* Vyverman, Sabbe & D.G. Mann in Vyverman *et al*., *Perinotia* Metzeltin &Lange-Bertalot, *Peronia* Brébisson &

Arnott ex Kitton and *Semiorbis* R.M. Patrick in Patrick & Reimer (Round *et al*. 1990). Os representantes de *Eunotia* caracterizam-se principalmente pelo sistema de rafe curto restrito aos polos e pela presença de rimopórtula (Wetzel *et al*. 2010). A maioria das espécies apresenta uma única rimopórtula em um dos ápices da valva, mas também podem ocorrer duas, ou ainda inexistir (Furey 2010). São assimétricas no eixo apical e geralmente isopolares, mas algumas espécies bem conhecidas apresentam heteropolaridade (Canani & Torgan 2013).

As células dos representantes de *Eunotia* podem ocorrer isoladamente, livres ou fixadas por hastes mucilaginosas, ou em longas colônias em forma de fitas (Furey 2010). São encontradas predominantemente no hábitat perifítico associadas a algum tipo de substrato, principalmente aderidas a macrófitas, e raramente ocorrem no fitoplâncton a exemplo de algumas espécies como *Eunotia asterionelloides* Hustedt e *E. zasuminensis* (Cabejszekówna) Körner, as quais são amplamente distribuídas nesse hábitat (Siver *et al.* 2006). Trata-se de um gênero quase exclusivo de ambiente dulcícola e mais diverso em águas distróficas ou ácidas (Kociolek 2000). Representa um dos maiores gêneros de diatomáceas e muitos táxons vêm sendo descritos como novidades para a ciência nos últimos anos. São estimadas pelo menos 1500 espécies e os mais otimistas sugerem entre 2000 a 4000 táxons para o gênero (Lange-Bertalot *et al*. 2011).

O conhecimento da biodiversidade de *Eunotia*, bem como das diatomáceas em geral, abrange principalmente o continente europeu, com grande variedade de trabalhos específicos (*e.g.* Alles *et al.* 1991, Mann *et al.* 2003, Ortiz-Lerín & Cambra 2007, Kulikovskiy *et al*. 2010, Lange-Bertalot *et al.* 2011, Pavlov & Levkov 2013) ou que incluem o gênero, como floras (*e.g.* Krammer & Lange-Bertalot 1991, Buczkó & Magyari 2007, Veselá & Johansen 2009). Na América do Norte, esses estudos são também bastante representativos (*e.g.* Patrick & Reimer 1966, Camburn *et al.* 1978, Camburn & Charles 2000, Novitski & Kociolek 2005, Siver *et al.* 2006, Siver & Wolfe 2007, Edlund & Brant 2010, Hamilton & Siver 2010, Furey *et al.* 2011).

Comparado com a região holártica, a ocorrência e distribuição de diatomáceas é pouco conhecida em águas tropicais interiores da América do Sul (Wetzel *et al.* 2011). Contudo, *Eunotia* é mais bem representado nessa região do que em qualquer outra parte do mundo (Metzeltin & Lange-Bertalot 1998). A maioria dos trabalhos em regiões tropicais foi realizada na Amazônia, onde há grande diversidade de espécies conhecidas (*e.g.* Patrick 1940, Hustedt 1952, Souza-Mosimann *et al*. 1997, Kociolek 2000, Sala *et al.* 2002, Díaz-Castro *et al*. 2003, Aprile & Mera 2007, Ferrari *et al*. 2007, Raupp *et al*. 2009) e recentemente propostas como novas para a ciência (*e.g.* Burliga *et al*. 2007, Wetzel *et al*. 2010, Wetzel *et al*. 2011, Burliga & Kociolek 2012), mas também incluem outras localidades como Cuba e os Andes (*e.g.* Toledo 1989, Rumrich *et al.* 2000, Toledo & Comas 2009).

No Brasil, além da região Amazônica, o conhecimento da biodiversidade de *Eunotia* inclui principalmente as regiões sul e sudeste do país. No Sul, os estudos concentram-se nos estados do Paraná e Rio Grande do Sul, sendo em sua maioria inventários da família Eunotiaceae (Ludwig & Valente-Moreira 1989, Fürstenberger & Valente-Moreira 2000, Bicca *et al*. 2011), trabalhos específicos do gênero (Torgan & Delani 1988, Tremarin *et al*. 2008, Bicca & Torgan 2009, Garcia *et al*. 2015), ou ainda, floras de diatomáceas com grande riqueza de representantes de *Eunotia* (*e.g.* Moreira-Filho *et al*. 1973, Torgan 1985, Laudares-Silva 1987, Oliveira *et al*. 2001, 2002, Raupp *et al*. 2006, Faria *et al.* 2010, Laux & Torgan 2011, Santos *et al*. 2011).

Na região Sudeste, o estudo específico de eunotióides é escasso. As maiores contribuições estão presentes em floras de diatomáceas que incluem o gênero. Dentre essas, Lyra (1971) registrou oito espécies de *Eunotia* encontradas em bromeliáceas no Estado do Rio de Janeiro e, para o Estado de Minas Gerais, Canani *et al*. (2011) identificaram oito espécies em águas oligotróficas do Rio do Salto. Ainda para o último Estado, Canani & Torgan (2013) descreveram duas espécies novas para o gênero: *E. ibitipocaensis* Cannani & Torgan e *E. saltoensis* Canani & Torgan.

No Estado de São Paulo, a primeira contribuição específica foi a de Bicudo *et al*. (1999), que inventariaram a Ordem Eunotiales para o Parque Estadual das Fontes do Ipiranga (PEFI), registrando 15 espécies de *Eunotia*. Em seguida, destaca-se o levantamento das Eunotiales (Morandi 2002) como parte da ficoflórula do Estado de São Paulo inserido no programa BIOTA/FAPESP. Essa dissertação de mestrado resultou na identificação de 38 táxons de *Eunotia*. Além desses trabalhos específicos sobre a ordem, há também contribuições florísticas que incluem o gênero, a exemplo da flora de diatomáceas do trecho a represar do Rio Paranapanema, onde foi encontrada apenas uma espécie de *Eunotia*; a flora da Lagoa do Diogo, que registrou 12 espécies (Magrin & Senna 1997); a do reservatório Cabuçu no Município de Guarulhos, a qual inventariou seis espécies (Moutinho *et al*. 2007); a de sedimentos superficiais dos reservatórios em cascata do rio Paranapanema, que registrou sete espécies (Fontana & Bicudo 2012) e a de Almeida & Bicudo (2014) que contribuiu com seis espécies e variedades do gênero. Ainda, para o Estado de São Paulo, *Eunotia trigona* foi recentemente proposta como novidade para a ciência (Fuhrmann *et al.* 2013).

A partir da revisão da literatura para o Estado de São Paulo, estima-se que ao redor de 90 espécies de *Eunotia* sejam conhecidas. Todavia, grande parte das informações não foi publicada e encontra-se na forma de dissertações e teses defendidas (*e.g.* Morandi 2002, Wengrat 2011, Rocha 2012, Fontana 2013). Além disto, presentemente, muitas espécies necessitam de revisão taxonômica devido ao amplo polimorfismo registrado, informações insuficientes sobre o material-tipo e, principalmente, pelas informações mais recentes com base em características ultraestruturais.

Ressalta-se que informações ecológicas as quais focam a associação da distribuição das espécies de *Eunotia* com variáveis limnológicas são muito escassas no Estado de São Paulo, no Brasil, bem como em regiões tropicais. Para o Estado de São Paulo, há duas importantes contribuições sobre bioindicação de diatomáceas epipsâmicas e qualidade da água de rios impactados pela poluição urbana em São Carlos, as quais relatam uma espécie de *Eunotia* (Bere & Tundisi 2010, 2011). Alguns estudos no país apresentam características ambientais dos locais de amostragem das diatomáceas a exemplo dos trabalhos realizados no Paraná (Moro & Fürstenberger 1993) e Rio Grande do Sul (Bicca & Torgan 2009). Para o Estado do Rio Grande do Sul, existem, também, dois catálogos que relacionam as exigências ambientais das diatomáceas registradas neste Estado, incluindo várias espécies de *Eunotia*, com base em extensa revisão de literatura internacional (Torgan & Biancamano 1991, Moro & Fürstenberger 1997). Ainda para este Estado, destaca-se a série de trabalhos sobre biomonitoramento de rios com diatomáceas epilíticas, incluindo preferências ecológicas das espécies e proposta de um índice de qualidade de água (*e.g.* Lobo *et al.* 2002, 2004; Salomoni *et al*. 2006; Hermany *et al.* 2006). Para as regiões tropicais, os estudos também são escassos e, na maioria, fornecem algumas características ambientais dos locais de amostragem das diatomáceas (*e.g.* Krasske 1948, Vyverman 1992, Sala *et al.* 2002, Taylor *et al*. 2007).

O presente estudo pretende ampliar e aprofundar o conhecimento taxonômico e ecológico das espécies do gênero *Eunotia* com base no estudo detalhado das populações encontradas em 32 reservatórios das regiões sul e sudeste do Estado de São Paulo (Bacia do Alto Tietê e bacias vizinhas). Tais represas abrangem amplo espectro de variação do estado trófico (ultraoligotrófico a hipereutrófico) e foram amostradas como parte de projeto mais amplo que utiliza as diatomáceas na bioindicação e na reconstrução de impactos antropogênicos (projeto AcquaSed: "*Diagnóstico basal e reconstrução de impactos antropogênicos na Represa Guarapiranga com vistas à sustentabilidade do abastecimento e ao gerenciamento da qualidade da água de reservatórios da RMSP*").

A proposta é inédita para regiões tropicais uma vez que integra informações taxonômicas e ecológicas específicas sobre representantes do gênero *Eunotia*. Neste sentido fornecerá base mais consistente para o melhor conhecimento das populações tropicais e de seu uso na bioindicação. Finalmente, como parte de um projeto mais amplo, multidisciplinar e interinstitucional (AcquaSed) contribuirá com informações autoecológicas que farão parte do banco regional de dados de diatomáceas visando seu uso na bioindicação e na elaboração de modelo de função de transferência diatomáceas-fósforo.

2. OBJETIVOS

2.1. Objetivo Geral

Ampliar e aprofundar o conhecimento taxonômico e ecológico das espécies e variedades do gênero *Eunotia* com base no estudo detalhado de populações planctônicas, perifíticas e de sedimentos superficiais de 32 represas distribuídas em cinco bacias hidrográficas das regiões sul e sudeste do Estado de São Paulo.

2.2. Objetivos Específicos

- Identificar e caracterizar a variabilidade morfológica das espécies e variedades de *Eunotia* encontradas na área de estudo;
- Buscar a resolução de problemas taxonômicos a partir do estudo do protólogo das espécies;
- Determinar a distribuição quantitativa das espécies e variedades de *Eunotia* na área de estudo, considerando distintos hábitats;
- Avaliar a preferência ecológica de espécies e variedades de *Eunotia* considerando variáveis limnológicas das represas estudadas.

3. MATERIAL E MÉTODOS

3.1. Área de estudo e amostragem

A área de abrangência deste estudo é a mesma selecionada para o projeto maior em que se insere a presente proposta (Projeto AcquaSed) o qual enfatiza as áreas de mananciais para a Região Metropolitana de São Paulo. Assim, inclui 32 represas situadas em cinco bacias hidrográficas (Figura 1): Bacia do Piracicaba, Capivari e Jundiaí (5 represas), Bacia do Alto Tietê (17 represas), Bacia do Médio Tietê/Alto Sorocaba (4 represas), Bacia Ribeira de Iguape/Litoral Sul (3 represas) e Bacia do Alto Paranapanema (3 represas).

A malha de amostragem abrange pelo menos um a dois pontos amostrais por sistema e, excepcionalmente, até seis locais em represas mais complexas (Complexo Billings e represa Guarapiranga), totalizando 57 pontos amostrais. As amostragens ocorreram no período de 2009 a 2014, em duas épocas do ano (verão e inverno) de forma a abranger os compartimentos da água (plâncton e perifíton) e dos sedimentos superficiais (inverno), ou seja, diferentes hábitats. No total foram 225 amostras, distribuídas em 109 fitoplanctônicas, 59 perifíticas e 57 de sedimentos superficiais.

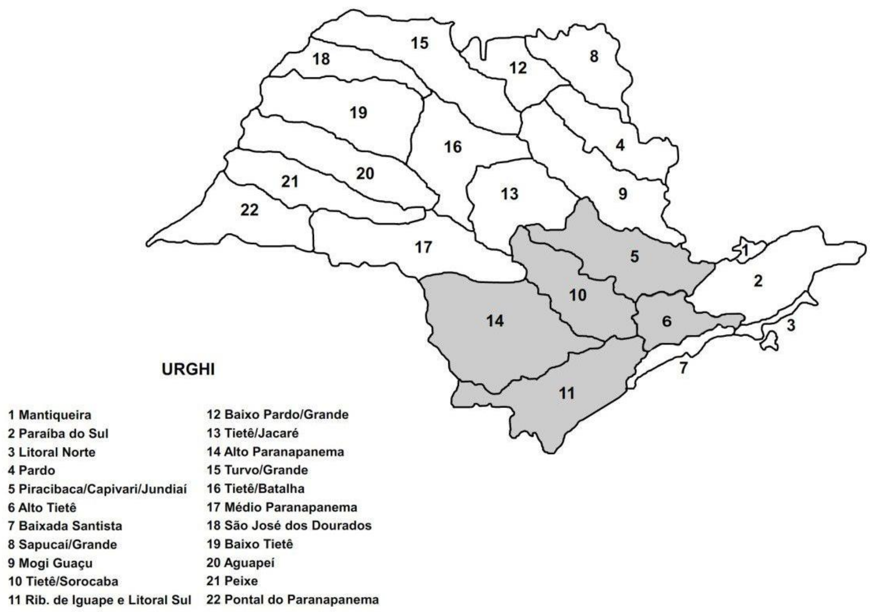


Figura 1. Localização das bacias hidrográficas do Piracicaba/Capivari/Jundiaí (5), Alto Tietê (6), Médio Tietê/Alto Sorocaba (10), Ribeira de Iguape/Litoral Sul (11) e Alto Paranapanema (14) no Estado de São Paulo (Fonte: modificado de Silva & Matsumura-Tundisi 2010).

As represas selecionadas abrangem amplo espectro de variação de estado trófico (ultraoligotrófico a hipereutrófico) e as amostragens foram acompanhadas de dados físicos e químicos da água, disponibilizados no banco de dados do projeto AcquaSed, o qual é coordenado pela equipe do Instituto de Botânica.

3.2. Coleta, fixação e preservação do material

As amostras fitoplanctônicas foram coletadas com garrafa de Van Dorn e rede de plâncton de 20 µm de abertura de malha. O perifíton foi coletado a partir de substratos naturais (rochas ou macrófitas), sempre que disponíveis, e os sedimentos superficiais, com testemunhador de gravidade (UWITEC). Neste caso, foram aproveitados os dois primeiros centímetros superficiais, que usualmente integram de um a dois anos de informação (Smol 2008). Tanto o fitoplâncton quanto o perifíton foram fixados e preservados em laboratório com solução aquosa de formalina a 4% (Bicudo & Menezes 2006). Os sedimentos foram mantidos em geladeira (sedimento úmido) e em freezer (liofilizados), conforme recomendado para amostras de sedimento (Battarbee *et al.* 2001).

3.3. Material para estudo

O projeto AcquaSed conta com cerca de 500 lâminas permanentes de diatomáceas (sem considerar as repetições) as quais incluem material planctônico, perifítico e de sedimentos superficiais. Dentre essas, após triagem, foram selecionadas 225 lâminas com maior representação de *Eunotia* e que contemplam todas as represas, considerando distintos hábitats, épocas do ano (verão/inverno) e profundidade das represas (local mais profundo e raso). As amostras brutas fixadas estão depositadas no Herbário Científico do Estado "Maria Eneyda P. Kauffmann Fidalgo" (SP) do Instituto de Botânica, Secretaria do Meio Ambiente do Estado de São Paulo. O laminário com as lâminas permanentes, que receberam os números de herbário (SP) correspondentes às amostras brutas, encontra-se no Núcleo de Pesquisa em Ecologia desta Instituição.

3.4. Preparação do material e análise taxonômica

O estudo taxonômico de diatomáceas requer uma etapa inicial de preparação das amostras, ou seja, de oxidação da matéria orgânica para permitir a visualização da decoração das frústulas. As amostras foram oxidadas conforme o protocolo do European Committee for Standartization (ECS 2003), que tem se mostrado mais eficiente na remoção da matéria orgânica, principalmente, de amostras de sedimentos. Para tanto, peróxido de hidrogênio (H_2O_2 35%) foi adicionado às amostras brutas e aquecido a 90°C em bloco digestor. Ácido clorídrico (HCl 37%) também foi adicionado.

Para análise em microscopia de luz, lâminas permanentes foram preparadas utilizando Naphrax como meio de inclusão (*IR* = 1,73). Para análise em microscopia eletrônica de varredura, alíquotas da amostra oxidada foram filtradas com água destilada em filtro de policarbonato 3-µm Isopore™ (Merck Millipore). Os filtros foram colocados em stubs de alumínio e cobertos com paládio em um metalizador BAL–TEC MED 020 por 30 segundos a 100 mA.

O exame taxonômico foi baseado na análise populacional de cada ambiente e hábitat de forma a registrar a variabilidade das características morfológicas e métricas dos táxons específicos e infraespecíficos. A delimitação das populações levou em conta a circunscrição de materiais-tipo disponíveis em literatura, sempre que possível. A análise dos materiais foi feita por meio de microscópio óptico binocular Zeiss, Axio Imager A2, equipado com contraste-de-fase, ocular micrometrada digital, luz polarizada circular em contraste (DIC) e sistema de captura de imagem com câmara acoplada, modelo MRc5. Ainda, por meio de microcópio eletrônico de varredura, Hitachi SU–70 (Hitachi High-Technologies Corporation, Tokyo, Japan), operado a 5 kV e com distância de trabalho de 10 mm, e realizado no laboratório do Departamento de Pesquisa e Inovação Ambiental (ERIN) do Luxembourg Institute of Science and Technology (LIST).

Os táxons foram identificados com auxílio de periódicos especializados, obras clássicas e modernas, tais como: Schmidt *et al*. (1913), Hustedt (1952), Patrick & Reimer (1966), Krammer & Lange-Bertalot (1991), Lange-Bertalot *et al.* (1996), Metzeltin & Lange-Bertalot (1998, 2007), Rumrich *et al.* (2000), Metzeltin *et al.* (2005), Siver *et al.* (2005), entre outros. Também foram utilizados obras e trabalhos específicos para espécies do gênero *Eunotia*, como Alles *et al*. (1991), Bicudo *et al*. (1999), Kociolek (2000), Ferrari *et al*. (2007), Ortiz-Lerín & Cambra (2007), Bicca & Torgan (2009), Wetzel *et al.* (2010), Bicca *et al*. (2011), Furey *et al*. (2011), Lange-Bertalot *et al*. (2011), Pavlov & Levkov (2013), Garcia *et al*. (2015) e sites especializados (http://westerndiatoms.colorado.edu/). A padronização dos nomes botânicos, basiônimos e sinonímias foram feitos conforme o Catalogue of Diatom Names (2011).

3.5. Análise quantitativa

Para avaliar a representatividade e a distribuição dos táxons de *Eunotia*, as amostras preparadas nas lâminas permanentes foram quantificadas. A contagem foi realizada em aumento de 1000x, utilizando microscópio óptico binocular Zeiss, Axio Imager A2, equipado com contraste-de-fase, luz polarizada circular em contraste (DIC) e sistema de captura de imagem. A unidade básica de contagem considerada foi a valva, de forma que frústulas completas foram consideradas como duas. Os fragmentos foram incluídos na contagem sempre que foi possível identificar a espécie e visualizar, pelo menos, 50% da valva (Battarbee *et al.* 2001). A contagem das valvas foi feita em transecções longitudinais nas lâminas permanentes e o limite de contagem foi estabelecido, principalmente, mediante contagem de pelo menos 500 valvas no total em cada amostra (Battarbee *et al.* 2001). Os resultados foram expressos em abundância relativa (% de dada espécie/variedade de *Eunotia* em relação ao total de valvas na unidade amostral – lâmina permanente).

3.6. Informações ecológicas

O estudo ecológico dos táxons de *Eunotia* compreendeu a avaliação de seus respectivos ótimos ecológicos em função de variáveis limnológicas disponíveis no banco de dados do Projeto AcquaSed. Também foi realizado a partir da revisão de literatura, como segue.

Os dados secundários disponibilizados no banco de dados do Projeto AcquaSed foram obtidos simultaneamente às coletas de material biológico (diatomáceas). As informações incluem variáveis físicas e químicas da água, tais como temperatura, pH, condutividade elétrica, oxigênio dissolvido, transparência da água, alcalinidade, série nitrogênio (nitrato, nitrogênio amoniacal, nitrogênio total), série fósforo (ortofosfato, fósforo total dissolvido e fósforo total), sílica solúvel reativa e o índice de estado trófico conforme Lamparelli (2004). Os métodos analíticos foram padronizados conforme APHA (2005) e detalhados em Bicudo *et al.* (2007) ou Wengrat & Bicudo (2011).

Para revisão de literatura sobre a ecologia dos táxons encontrados foram consultadas obras variadas (Lowe 1974; Wolf 1982; Denys 1991; Van Dam *et al.* 1994; Lobo *et al.* 1995, 1996; Moro & Fürstenberger 1997; Schönfelder *et al.* 2002; Taylor *et al.* 2007; entre outras); o programa OMNIDIA, versão 7.5 (Lecointe *et al.* 1993), que oferece um banco de dados completo sobre a ecologia de aproximadamente 14.000 táxons, bem como a partir de busca em sites específicos de diatomáceas (http://craticula.ncl.ac.uk; http://westerndiatoms.colorado.edu/).

O ótimo ecológico das espécies/variedades foi calculado a partir do valor médio das concentrações da variável ambiental de interesse ponderado pela abundância da espécie (média ponderada) em todas as unidades amostrais, conforme equação a seguir (ter Braak & van Dam 1989):

$$u_k = \frac{\sum_{i=1}^{n} y_{ik} x_i}{\sum_{i=1}^{n} y_{ik}}$$

u_k = ótimo ecológico da espécie k

y_{ik} = abundânica da espécie k na amostra i

x_{ik} = concentração da variável de interesse na amostra i

Devido à distribuição diferencial dos táxons, foram calculados os ótimos das espécies para cada tipo de hábitat. Para tanto, foram consideradas apenas as espécies com frequência de ocorrência igual ou maior do que 10% nas unidades amostrais do hábitat em questão. Este procedimento minimiza problemas de distorção das informações devido à baixa representatividade da espécie no banco de dados. Desta forma, nem sempre foi possível determinar o ótimo ecológico dos táxons. Para tais cálculos, foram utilizadas as seguintes variáveis de interesse: pH, condutividade, nitrogênio total e fósforo total.

4. ORGANIZAÇÃO DA DISSERTAÇÃO

A dissertação está organizada em partes gerais (introdução, materiais e métodos, considerações finais) e os resultados estão apresentados em dois capítulos que serão submetidos à publicação, os quais são apresentados na formatação do veículo de publicação. Finalmente, são apresentados apêndices para consulta a informações mais detalhadas do estudo. Os capítulos são:

Capítulo 1: "*Eunotia* sp. nov. 1 a new planktonic species from Brazil and comparison with the type of *Fragilaria braunii* Hustedt (Bacillariophyceae)" a ser submetido a Fottea.

Capítulo 2: "Taxonomy and ecology of *Eunotia* species (Bacillariophyta) in 32 southeastern Brazilian reservoirs" a ser submetido a Bibliotheca Diatomologica.

5. REFERÊNCIAS BIBLIOGRÁFICAS

Alles, E., Nörpel-Schempp, M. & Lange-Bertalot, H. 1991. Zur Systematik und Ökologie charakteristischer Eunotia-Arten (Bacillariophyceae) in elektrolytarmen Bachoberläufen. Nova Hedwigia 53 (1-2): 171-213.

Almeida, P.D. & Bicudo, D.C. 2014. Diatomáceas planctônicas e de sedimento superficial em represas de abastecimento da Região Metropolitana de São Paulo, SP, Sudeste do Brasil. Hoehnea 41: 182-207.

APHA – American Publication Health Association. 2005. Standard methods for the examination of water and wastewater. 21 ed. Association, Washington DC.

Aprile, F.M. & Mera, P.A.S. 2007. Fitoplâncton e fitoperifíton de um rio de águas pretas da Amazônia periférica do Norte, Brasil. Brazilian Journal of Aquatic Science and Technology 11 (2): 1-14.

Battarbee, R.W., Jones, V., Flower, R.J., Cameron, N., Bennion, H., Carvalho, L. & Juggins, S. 2001. Diatoms. *In*: J.P. Smol, H.J.B. Birks & W.M. Last (eds.). Tracking Environmental Change Using Lake Sediments. Kluwer Academic Publishers, London, v. 3, pp. 155-203.

Bere, T. & Tundisi, J.G. 2010. Epipsammic diatoms in streams influenced by urban pollution, São Carlos, SP, Brazil. Brazilian Journal of Biology 70(4): 921-930.

Bere, T. & Tundisi, J.G. 2011. Applicability of borrowed diatom-based water quality assessment indices in streams around São Carlos-SP, Brazil. Hydrobiologia 673: 179-192.

Berzano, M., Marcheggiani, S., Rombini, S. & Spurio, R. 2012. The application of oligonucleotide probes and microarrays for the identification of freshwater diatoms. Hydrobiologia 695: 57-72.

Bicca, A.B. & Torgan, L.C. 2009. Novos registros de *Eunotia* Ehrenberg (Eunotiaceae-Bacillariophyta) para o Estado do Rio Grande do Sul e Brasil. Acta Botanica Brasilica 23 (2): 427-435.

Bicca, A.B., Torgan, L.C. & Santos, C.B. 2011. Eunotiaceae (Eunotiales, Bacillariophyta) em ambientes lacustres na Planície Costeira do Sul do Brasil. Revista Brasileira de Botânica 34: 1-19.

Bicudo, C.E.M. & Menezes, M. 2006. Gêneros de algas continentais do Brasil. Chave para identificação e descrições. 2 ed. Editora RIMA, São Carlos.

Bicudo, D.C., Morandi, L.L. & Ludwig, T.A.V. 1999. Criptógamos do Parque Estadual das Fontes do Ipiranga, São Paulo, SP. Algas, 13: Bacillariophyceae (Eunotiales). Hoehnea 26: 173-184.

Bicudo, D.C., Fonseca, B.M., Bini, L.M., Crossetti, L.O., Bicudo, C.E.M. & Araújo-Jesus, T. 2007. Undesirable side-effects of water hyacinth control in a shallow tropical reservoir. Freshwater Biology 52:1120-1133.

Buczkó, K. & Magyari, E. 2007. The Holocene diatom flora of Lake Saint Anna (Eastern Carpathians, Europe). Algological Studies 124: 1-28.

Burliga, A.L. & Kociolek, J.P. 2012. Four new *Eunotia* Ehrenberg species (Bacillariophyceae) from pristine regions of Carajás National Forest, Amazonia, Brazil. Nova Hedwigia 141: 53-70.

Burliga, A.L., Torgan, L.C. & Beaumord, A.C. 2007. *Eunotia ariengae* sp. nov., an Epilithic Diatom From Brazilian Amazon. Diatom Research 22: 247-253.

Camburn, K.E. & Charles, D.F. 2000. Diatoms of low-alkalinity lakes in the northeastern United States. The Academy of Natural Sciences of Philadelphia, Special Publication 18: 1-152.

Camburn, K.E., Lowe, R.L. & Stoneburner, D.L. 1978. The haptobenthic diatom flora of Long Branch Creek, South Carolina. Nova Hedwigia 30: 149-55.

Canani, L.G.C & Torgan, L.C. 2013. Two new *Eunotia* species with subapical costae, an uncommon structure for the genus. Diatom Research 28 (4): 395-406.

Canani, L.G.C., Menezes, M. & Torgan, L.C. 2011. Diatomáceas epilíticas de águas oligotróficas e ácidas do Sudeste do Brasil. Acta Botanica Brasilica 25: 130-140.

Catalogue of Diatom Names. 2011. Diatom Collection. Disponível em http://research.calacademy.org/izg/research/diatom (acesso em 12-XII-2013).

Chepurnov, V.A., Mann, D.G., Sabbe, K. & Vyverman, W. 2004. Experimental Studies on Sexual Reproduction in Diatoms. International Review of Cytology 237: 91-154.

Denys, L. 1991. A checklist of the diatoms in the Holocene deposits of the western Belgian coastal plain with a survey of their apparent ecological requirements, I: introduction, ecological code and complete list. Service Geologique de Belgique 246: 1-41.

Díaz-Castro, J.G., Souza-Mosimann, R.M., Laudares-Silva. R. & Forsberg, B.R. 2003. Composição da comunidade de diatomáceas perifíticas do Rio Jaú, Amazonas, Brazil. Acta Amazonica 33 (4): 583-606.

ECS - European Committee for Standartization. 2003. Water quality - Guidance standard for the routine sampling and pretreatment of benthic diatoms from rivers. Disponível em http://www.safrass.com/partners_area/BSI%20Benthic%20diatoms.pdf (acesso em 27-V-2013).

Edlund, M.B. & Brant, L.A. 2010. *Eunotia charliereimeri*, a new *Eunotia* species (Bacillariophyceae) with amphoroid frustule symmetry. Proceedings of the Academy of Natural Sciences of Philadelphia 160: 47-56.

Faria, D.M., Tremarin, P.I. & Ludwig, T.A.V. 2010. Diatomáceas perifíticas da represa Itaqui, São José dos Pinhais, Paraná: Fragilariales, Eunotiales, Achnanthales e *Gomphonema* Ehrenberg. Biota Neotropica 10 (3): 415-427.

Ferrari, F., Procopiak, L.K., Alencar, Y.B. & Ludwig, T.A.V. 2007. Eunotiaceae (Bacillariophyceae) em igarapés da Amazônia Central, Manaus e Presidente Figueiredo, Brasil. Acta Amazonica 37: 1-16.

Flower, R.J. 2005. A Review of Diversification Trends in Diatom Research with Special Reference to Taxonomy and Environmental Applications Using Examples from Lake Baikal and Elsewhere. Proceedings of the Academy of Natural Sciences of Philadelphia 56: 107-128.

Fontana, L.S. 2013. Reconstrução paleolimnológica da eutrofização na represa Guarapiranga com base em multitraçadores biogeoquímicos. Tese de Doutorado, Universidade Estadual Paulista, Rio Claro.

Fontana, L. & Bicudo, D.C. 2012. Biodiversidade e distribuição das diatomáceas (Bacillariophyceae) de sedimentos superficiais nos reservatórios em cascata do rio Paranapanema, SP/PR, Brasil. Hoehnea 39 (4): 587-614.

Fourtanier, E. & Kociolek, J.P. 2003. Addendum to the catalogue of diatom generic names. Diatom Research 18: 245-258.

Fuhrmann, A., Metzeltin, D. & Tremarin, P.I. 2013. A triangular *Eunotia* (Bacillariophyceae) in southeastern Brazil: *Eunotia trigona* sp. nov. Acta Botanica Brasilica 27: 694-697.

Furey, P. 2010. *Eunotia*. Diatoms of the United States. Disponível em http://westerndiatoms.colorado.edu/taxa/genus/eunotia (acesso em 12-VII-2013).

Furey, P.C., Lowe, R.L. & Johansen, J.R. 2011. *Eunotia* Ehrenberg (Bacillariophyta) of the Great Smoky Mountains National Park, USA. Bibliotheca Diatomologica 56: 1-133.

Fürstenberger, C.B. & Valente-Moreira, I.M. 2000. Diatomáceas (Bacillariophyta) perifíticas da lagoa Tarumã, Ponta Grossa, Paraná, Brasil. 2. Eunotiaceae. Insula 29: 117-134.

Garcia, D.R., Bueno, N.C., Nardelli, M.S., Tremarin, P.I., Ludwig, T.A.V. & Baumgartner, G. 2015. *Eunotia* Ehrenberg (Bacillariophyceae) in the Hercílio River, Santa Catarina, southern Brazil. Brazilian Journal of Botany 38 (3): 623-637.

Hamilton, P.B. & Siver, P.A. 2010. A Morphological Investigation of *Eunotia fennica* (Bacillariophyceae) from a Freshwater Acidic Pond in Newfoundland, Canada. Proceedings of the Academy of Natural Sciences of Philadelphia 160: 89-98.

Hermany, G., Lobo, E.A., Schwarzbold, A. & Oliveira, M.A. 2006. Ecology of the epilithic diatom comunuty in a low-order stream system of the Guaíba hidrographical region: subsidies to the enviromental monitoring of Southern Brazilian aquatic system. Acta Limnologica Brasiliensia 18: 9-27.

Hustedt, F. 1952. Neue und wenig bekannte Diatomeen. III. Phylogenetische Variationen bei den raphidioiden Diatomeen. Bericht der Deutschen Botanischen Gessellschaft 65 (5): 133-144.

Kociolek, J.P. 2000. Valve ultrastructure of some Eunotiaceae (Bacillariophyceae), with comments on the evolution of the raphe system. Proceedings of the California Academy of Sciences 52 (2): 11-21.

Krammer, K. & Lange-Bertalot, H. 1991. Bacillariophyceae 4. Teil: Achnanthaceae Kritische Ergänzungen zu s.l., Navicula *s.str.*, *Gomphonema* Gesamtliteraturverzeichnis Teil 1-4. *In:* H. Ettl, G. Gärtner, H. Heynig, & D. Mollenhauer (eds.). Suesswasserflora von Mitteleuropa. Band 2/4. Gustav Fischer Verlag, Sttutgart, pp. 1-437.

Krasske, G. 1948. Diatomeen tropischer Moosrasen. Svensk Botanisk Tidskrift 42 (4): 404-443.

Kulikovskiy, M.S., Lange-Bertalot, H., Witkowski, A., Dorofeyuk, N.I. & Genkal, S.I. 2010. Diatom assemblages from Sphagnum bogs of the world. I. Nur bog in northern Mongolia. Bibliotheca Diatomologica 55: 1-326.

Lamparelli, M.C. 2004. Graus de trofia em corpos d'água do Estado de São Paulo: Avaliação dos métodos de monitoramento. Tese de Doutorado, Universidade de São Paulo, São Paulo.

Lange-Bertalot, H. & Metzeltin, D. 1996. Indicators of Oligotrophy. 800 taxa representative of three ecologically distinct lake types. Carbonate buffered – Oligodystrophic – Weakly buffered soft water. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books, Königstein, v. 2, pp. 1-390.

Lange-Bertalot, H., Bąk, M. & Witkowski, A. 2011. *Eunotia* and some related genera *In:* H. Lange-Bertalot (ed.). Diatoms of Europe. A.R.G. Gantner Verlag K.G., Ruggell, distributed by Koeltz Scientific Books, Koenigstein, pp. 1-747.

Laudares-Silva, R. 1987. Estudo taxonômico das diatomáceas (Bacillariophyceae) coletadas no Arroio do Faxinal (Sanga da Água Boa), Torres, Rio Grande do Sul, Brasil. Ínsula 17: 3-176.

Laux, M. & Torgan, L.C. 2011. Diatomáceas com plastídeos no plâncton da foz dos rios do Delta do Jacuí, sul do Brasil: um complemento à taxonomia tradicional. Iheringia, Série Botânica 66: 109-132.

Lecointe, C., Coste, M. & Prygiel, J. 1993. "Omnidia": software for taxonomy, calculation of diatom indices and inventories management. Hydrobiologia 269/270: 509-513.

Lobo, E.A., Kirst, A., Costa, A.B. & Oliveira, M.A. 1995. Estudo na qualidade da água do Arroio Boa Vista, Município de Carlos Barbosa, Rio Grande do Sul. Biociências 3(1): 43-63.

Lobo, E.A., Callegaro, V.L.M., Schullers, S., Oliveira, M.A., Salomoni, S. & Asai, K. 1996. Pollution tolerant diatoms from rivers located in the Jacuí Basin, Rio Grande do Sul, Brazil. Iheringia, Série Botânica 47: 43-70.

Lobo, E.A., Callegaro, V.L. & Bender, P. 2002. Utilização de algas diatomáceas epilíticas como indicadoras da qualidade da água em rios e arroios da Região Hidrográfica do Guaíba, RS, Brasil. Edunisc, Santa Cruz do Sul.

Lobo, E.A., Callegaro, V.L., Hermany, G.; Bes, D., Wetzel, C.E. & Oliveira, M.A. 2004. Use of epilithic diatoms as bioindicator from lotic systems in southern Brazil, with special emphasis on eutrophication. Acta Limnologica Brasiliensia 16(1): 25–40.

Lowe, R.L. 1974. Environmental Requirements and Pollution Tolerance of Freshwater Diatoms. National Environmental Research Center, Ohio.

Ludwig, T.A.V. & Valente-Moreira, I.T. 1989. Contribuição ao conhecimento da diatomoflórula do Parque Regional do Iguaçu, Paraná, Brasil: I. Eunotiaceae (Bacillariophyceae). Arquivos de Biologia e Tecnologia 32: 543-560.

Lyra, L.T. 1971. Algumas diatomáceas encontradas em Bromeliáceas, Brasil. Memórias do Instituto Oswaldo Cruz 69: 129-139.

Magrin, A.G.E. & Senna, P.A.C. 1997. Composição e dinâmica de diatomáceas planctônicas em uma lagoa da planície de inundação do Médio Mogi-Guaçu, Estado de São Paulo, Brasil. 3 ed. Anais do 8º Seminário Regional de Ecologia, São Carlos, pp. 247-276.

Mann, D.G., Chepurnov, V.A. & Idei, M. 2003. Mating System, Sexual Reproduction, and Auxosporulation in the Anomalous Raphid Diatom *Eunotia* (Bacillariophyta). Journal of Phycology 39: 1067-1084.

Metzeltin, D. & García-Rodriguez, F. 2003. Las Diatomeas Uruguayas. D.I.R.A.C, Montevideo.

Metzeltin, D. & Lange-Bertalot, H. 1998. Tropische Diatomeen in Südamerika I. 700 überwiegend wenig bekannte oder neue Taxa reprasentativ als Elemente der neotropischen Flora [Tropical diatoms of South America I: About 700 predominantly rarely known or new taxa representative of the neotropical flora]. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Diversity-Taxonomy-Geobotany. Koeltz Scientific Books, Königstein, v. 5, pp. 1-695.

Metzeltin, D. & Lange-Bertalot, H. 2007. Tropical diatoms of South America II. Special remarks on biogeography disjunction. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Diversity-Taxonomy-Biogeography. A.R.G. Gantner Verlag K.G., Ruggell, v. 18, pp.1-877.

Metzeltin, D., Lange-Bertalot, H. & García-Rodríguez, F. 2005. Diatoms of Uruguay. Compared with other taxa from South America and elsewhere. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy-Biogeography-Diversity. A.R.G. Gantner Verlag K.G., Ruggell, v. 15, pp. 1-736.

Morales, E.A., Chávez, V.S. & Fernández, E. 2009. Diatomeas (Bacillariophyta): ¿Por qué debemos incorporarlas en estudios de la biodiversidad Boliviana? *In:* Simposio XXX Aniversario Instituto de Ecología, La Paz. Universidad Mayor de San Andrés, La Paz, pp. 1-6.

Morandi, L.L. 2002. Eunotiales (Bacillariophyceae) de águas continentais do estado de São Paulo: levantamento florístico. Dissertação de Mestrado, Universidade de São Paulo, Ribeirão Preto.

Moreira-Filho, H., Valente-Moreira, I.M. & Cecy, I.I.M. 1973. Diatomáceas na Barragem de Captação D'Água (SANEPAR) do Rio Iguaçu, em Curitiba, Estado do Paraná. Acta Biológica Paranaense 2: 133-145.

Moro, R.S. & Fürstenbeger, C.B. 1993. Diatomáceas (Bacillariophyceae) da Lagoa Dourada (Parque Estadual de Vila Velha), Paraná, Brasil. Acta Biológica Paranaense 22(1-4): 15-30.

Moro, R.S. & Fürstenbeger, C.B. 1997. Catálogo dos principais parâmetros ecológicos de diatomáceas não-marinhas. Editora da Universidade Estadual de Ponta Grossa, Ponta Grossa.

Moutinho, S.O., Garcia, M.J. & De Oliveira, P.E. 2007. Flora diatomácea do reservatório Cabuçu, Município de Guarulhos, (SP): análise qualitativa. Revista UnG, Geociências 6: 32-63.

Novitski, L. & Kociolek, P. 2005. Preliminary light and scanning electron microscope observations of marine fossil *Eunotia* species with comments on the evolution of the genus *Eunotia*. Diatom Research: 137-143.

Oliveira, M.A., Torgan, L.C., Lobo, E.A. & Scharzbold, A. 2001. Association of periphytic diatom species of artificial substrate in lotic environments in the Arroio Sampaio Basin, RS, Brazil: Relationships with abiotic variables. Brazilian Journal of Biology 61 (4): 523-540.

Oliveira, M.A., Torgan, L.C. & Rodrigues, S.C. 2002. Diatomáceas perifíticas dos Arroios Sampaio e Sampainho, Rio Grande do Sul, Brasil. Acta Botanica Brasilica 16 (2): 151-160.

Ortiz-Lerín, R. & Cambra, J. 2007. Distribution and taxonomic notes of Eunotia Ehrenberg 1837. (Bacillariophyceae) in rivers and streams of Northern Spain. Limnetica 26: 415-434.

Patrick, R.M. 1940. Diatoms of Northeastern Brazil. Part I. - Coscinodiscaceae, Fragilariceae and Eunotiaceae. Proceedings of the Academy of Natural Sciences of Philadelphia 92: 191-227.

Patrick, R.M. & Reimer, C.W. 1966. The diatoms of the United States. Exclusive of Alaska and Hawaii. Fragilariaceae, Eunotiaceae, Achnanthaceae, Naviculaceae. v. 1. Monographs of the Academy of Natural Sciences of Philadelphia 13: 1-688.

Pavlov, A. & Levkov, Z. 2013. Diversity and distribution of taxa in the genus Eunotia Ehrenberg (Bacillariophyta) in Macedonia. Phytotaxa 86 (1): 1-117.

Raupp, S.V., Torgan, L.C. & Baptista, L.R.M. 2006. Composição e variação temporal de diatomáceas (Bacillariophyta) no plâncton da represa de Canastra, sul do Brasil. Iheringia, Série Botânica 61 (1-2):105-134.

Raupp, S.V., Torgan, L.C. & Melo, S. 2009. Planktonic diatom composition and abundance in the Amazonian floodplain Cutiuaú Lake are driven by the flood pulse. Acta Limnologica Brasiliensia 21 (2): 227-234.

Rocha, A.C.R. 2012. Influência do Hábitat e Estado Trófico na Biodiversidade e Distribuição das Diatomáceas (Bacillariophyta) em Reservatórios da Sub-bacia do Alto Rio Tietê, São Paulo. Tese de Doutorado, Universidade Estadual Paulista, Rio Claro.

Round, F.E., Crawford, R.M. & Mann, D.G. 1990. The Diatoms. Biology and morphology of the genera. Cambridge University Press, Cambridge.

Rumrich, U., Lange-Bertalot, H. & Rumrich, M. 2000. Diatoms of the Andes from Venezuela to Patagonia/Tierra del Fuego. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books, Königstein, v. 9, pp. 1-649.

Sala, S.E., Duque, S.R., Núnez-Avellaneda, M. & Lamaro, A.A. 2002. Diatoms from the Colombian Amazon: Some species of the genus Eunotia (Bacillariophyceae). Acta Amazonica 32 (4): 589-603.

Salomoni, S.E., Rocha, O., Callegaro, V.L.M. & Lobo, E.A. 2006. Epilithic diatoms as indicators of water quality in the Gravataí River, Rio Grande do Sul, Brazil. Hydrobiologia 559: 233-246.

Santos, E.M., Tremarin, P.I. & Ludwig, T.A.V. 2011. Diatomáceas perifíticas em *Potamogeton polygonus* Cham. & Schltdl.:citações pioneiras para o estado do Paraná. Biota Neotropica 11 (3): 303-315.

Schmidt, A. 1913. Atlas der Diatomaceen-kunde. Leipzig. O.R. Reisland Series III (Heft 72): pls 241-336 [F. Hustedt].

Schönfelder, I., Gelbrecht, J., Schönfelder, J. & Steinberg, C. E. W. 2002. Relationship between littoral diatoms and their chemical environment in northeasthern German lakes and rivers. Journal of Phycology 38: 66-82.

Silva, W.M. & Matsumura-Tundisi, T. 2010. Checklist dos Copepoda *Cyclopoida* de vida livre de água doce do Estado de São Paulo, Brasil. Biota Neotropica 11 (1): 1-11.

Siver, P.A. & Wolfe, A.P. 2007. *Eunotia* spp. (Bacillariophyceae) from Middle Eocene lake sediments and comments on the origino f the diatom raphe. Canadian Journal of Botany 85: 83-90.

Siver, P.A., Hamilton, P.B., Stachura-Suchoples, K. & Kociolek, J.P. 2005. Diatoms of North America: The freshwater flora of Cape Cod, Massachusetts, U.S.A. *In:* H. Lange-Bertalot (ed.). Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books, Königstein, v. 14, pp. 1-463.

Siver, P.A.; Hamilton, P.B. & Morales, E.A. 2006. Two new planktic species of *Eunotia* (Bacillariophyceae) from freshwater waterbodies in North Carolina, U.S.A. Algological Studies 119: 1-16.

Smol, J.P. 2008. Pollution of lakes and rivers: a paleoenvironmental perspective. 2 ed. Blackwell Publishing, Malden.

Smol, J.P. & Stoermer, E.F. 2010. The Diatoms: Applications for the Environmental and Earth Sciences. 2 ed. Cambridge University Press, Cambridge.

Souza-Mosimann, R.M., Tavares, A.S. & Freitas, V.P. 1997. Contribuição ao conhecimento da diatomoflórula do conteúdo estomacal de algumas espécies de peixes da Amazônia. I. Myleus sp. (Pacu) do Lago do Prato, AM., Brasil. Acta Amazonica 27: 9-26.

Taylor, J.C., Harding, W.R. & Archibald, G.M. 2007. An Illustrated Guide to Some Common Diatom Species from South Africa. WRC Report TT 282/07. Water Research Commission, Pretoria. 178 pls.

ter Braak, C.J.F. & van Dam, H. 1989. Inferring pH from diatoms – a comparison of old and new methods. Hydrobiologia 178:209-223.

Toledo, L. 1989. Bacillariophyceae del estanque del Jardín Botánico de Cienfuegos, Cuba. Acta Botânica Cubana 83: 1-12.

Toledo, L. & Comas, A. 2009. Sinopsis Taxonómica de la Familia Eunotiaceae Ehrenberg (Eunotiaceae Kütz. 1844, Bacillariophyceae) de Cuba. Boletin de La Sociedad Española de Ficología 41: 7-12.

Torgan, L.C. 1985. Estudo taxonômico de diatomáceas (Bacillariophyceae) da represa de Águas Belas, Viamão, Rio Grande do Sul, Brasil. Iheringia, Série Botânica 33: 17-104.

Torgan, L.C. & Biancamano, M.I. 1991. Catálogo das diatomáceas (Bacillariophyceae) referidas para o estado do Rio Grande do Sul, Brasil, no período de 1973 a 1990. Santa Cruz do Sul, Caderno de Pesquisa 3 (1): 1-201.

Torgan, L.C. & Delani, O.M. 1988. Estudo taxonômico de diatomáceas (Bacillariophyceae) do "Complexo Banhado Grande", Rio Grande do Sul, Brasil: representantes do gênero *Eunotia* Ehrenberg. Iheringia, Série Botânica 38: 81-107.

Tremarin, P.I., Ludwig, T.A.V. & Moreira Filho, H. 2008. *Eunotia* Ehrenberg (Bacillariophyceae) do rio Guaraguaçu, litoral do Paraná, Brasil. Acta Botanica Brasilica 22 (3): 845-862.

Van Dam, H., Mertens, A. & Sinkeldam, J. 1994. A coded checklist and ecological indicator values of freshwater diatoms from the Netherlands. Netherlands Journal of Aquatic Ecology 28: 117-133.

Veselá, J. & Johansen, J.R. 2009. The Diatom Flora of Ephemeral Headwater Streams in the Elbsandsteingebirge Region of the Czech Republic. Diatom Research 24: 443-477.

Vyverman, W. 1992. Altitudinal Distribution of Non-cosmopolitan Desmids and Diatoms in Papua New Guinea. British Phycology Journal 27: 49-63.

Wengrat, S. 2011. Biodiversidade e distribuição das diatomáceas no Complexo Billings, São Paulo: influência da compartimentalização espacial e do estado trófico. Dissertação de Mestrado, Instituto de Botânica da Secretaria do Meio Ambiente, São Paulo.

Wengrat, S. & Bicudo, D.C. 2011. Spatial evaluation of water quality in an urban reservoir (Billings Complex, southeastern Brazil). Acta Limnologica Brasiliensia 23 (2): 200-216.

Wetzel, C.E., Ector, L., Hoffmann, L. & Bicudo, D.C. 2010. Colonial planktonic *Eunotia* (Bacillariophyceae) from Brazilian Amazon: Taxonomy and biogeographical considerations on the E. asterionelloides species complex. Nova Hedwigia 91 (1-2): 49-86.

Wetzel, C.E., Ector, L., Hoffmann, L., Lange-Bertalot, H. & Bicudo, D.C. 2011. Two new periphytic *Eunotia* species from the Neotropical Amazonian 'black waters', with a type analysis of E. braunii. Diatom Research 26: 135-146.

Williams, D.M. & Reid, G. 2006a. Large and species rich taxa: diatoms, geography and taxonomy. *In:* T.R. Hodkinson, & J.A.N. Parnell (eds.). Reconstructing the Tree of Life: Taxonomy and Systematics of Species Rich Taxa. CRC Press, New York, pp. 299-316.

Williams, D.M. & Reid, G. 2006b. Fossils and the tropics, the Eunotiaceae (Bacillariophyta) expanded: A new genus for the Upper Eocene fóssil diatom *Eunotia reedii* and the recent tropical marine diatom *Amphora reichardtiana*. European Journal of Phycology 41: 147-154.

Wolf, H. 1982. Method of coding of ecological data from diatoms for computer utilization. Mededelingen Rijks Geologische Dienst 36: 95-98.

6. CAPÍTULO 1 – *Eunotia* sp. nov. 1 a new planktonic species from Brazil and comparison with the type of *Fragilaria braunii* Hustedt (Bacillariophyceae)

Lívia Franco da Costa[1,2*], Carlos E. Wetzel[2], Luc Ector[2] & Denise de Campos Bicudo[1]
[1]Instituto de Botânica, Núcleo de Ecologia, São Paulo, Brazil.
[2]Luxembourg Institute of Science and Technology (LIST), Environmental Research and Innovation Department (ERIN), Belvaux, Luxembourg.
*Author for correspondence: livia.fcosta@hotmail.com

Abstract: *Eunotia* is a diatom genus characterized by having a short raphe system restricted to both valve poles and by the presence of rimoportulae. Because of their 'unique' morphological characteristics, it is of great importance for understanding the phylogenetic relationships between raphid and araphid diatoms. As part of a survey examining the genus *Eunotia*, a new planktonic diatom species, *Eunotia* sp. nov. 1, is described from oligotrophic and acidic reservoirs in São Paulo state, southeast Brazil. It is a distinctive eunotioid species having a 'fragilarioid' aspect with long cells, spines and a short distinct raphe. Contrarily to most *Eunotia* species, this new species does not possess rectangular frustules in girdle view. It was commonly found in the phytoplankton community and seems to be morphologically adapted to an open water existence such as *E. croatana* and *E. pseudofragilaria*, besides some species from the *Eunotia asterionelloides* species complex. Likewise similar *Fragilaria*, the type material of *Fragilaria braunii* was analysed and their morphologies are discussed.

Key words: Eunotiaceae, fragilarioid, phytoplankton, reservoirs, South America, taxonomy

Introduction

Eunotia Ehrenberg is one of the largest genus of freshwater diatoms, being estimated at least 1,500 species (Lange-Bertalot *et al.* 2011). In recent years, many taxa have been described as new and revisions were made mainly focusing the diversity of the genus, which seemed to be underestimated (*e.g.* Wetzel *et al*. 2010, 2011, Lange-Bertalot *et al*. 2011, Potapova *et al*. 2014, Van de Vijver *et al*. 2014, Kulikovskiy *et al.* 2015). *Eunotia* is also the most representative genus belonging to the family Eunotiaceae Kützing within Subclass Eunotiophycideae D.G Mann, besides other genera included as *Actinella* F.W. Lewis, *Amphorotia* D.M. Williams & G. Reid, *Colliculoamphora* D.M. Williams & G. Reid, *Desmogonium* Ehrenberg in Schomburgk, *Eunophora* Vyverman, Sabbe & D.G. Mann in

Vyverman *et al.*, *Perinotia* Metzeltin &Lange-Bertalot, *Peronia* Brébisson & Arnott ex Kitton and *Semiorbis* R.M. Patrick in Patrick & Reimer (Round *et al*. 1990).

The genus *Eunotia* is characterized by having a short raphe system restricted to both valve poles with an internally well-developed helicloglossae and the presence of rimoportula (Round *et al*. 1990, Siver *et al*. 2006). Due to the 'unique' morphological characteristics (i.e. having raphe and rimoportulae), *Eunotia* species are of great importance for understanding the phylogentic relationships between raphid and araphid diatoms (Simonsen 1979, Williams & Reid 2006). Most species of the genus are from freshwater environments and more diversified in dystrophic or acidic waters, found predominantly in the periphyton, rarely occurring in the phytoplankton (Kociolek 2000, Siver *et al*. 2006). Despite this, some species are known by its planktonic lifeform such as *Eunotia asterionelloides* Hustedt, *E. croatana* Siver, P.B. Hamilton & E. Morales, *E. gomesii* C.E. Wetzel & Ector, *E. loboi* C.E. Wetzel & Ector, *E. pseudofragilaria* Siver, P.B. Hamilton & E. Morales, *E. tukanorum* C.E. Wetzel & D. Bicudo, *E. waimiriorum* C.E. Wetzel and *E. zasuminensis* (Cabejszekowna) Körner.

As part of a survey examining the genus *Eunotia* in São Paulo State reservoirs, planktonic populations of a new species with particular features were observed. The objective of this study is to describe the new taxa. Additionally light (LM) and scanning electron microscope (SEM) techniques were used to analyze the type material of *Fragilaria braunii* Hustedt, a similar species described from Brazilian Amazon, and easily mistanken with the new species in light microscopy as other *Fragilaria* species.

Materials and methods

Study Area

Pedro Beicht and Ribeirão do Campo reservoirs are located in conservation units of Atlantic Forest remnants in the Alto Tietê River Basin, State of São Paulo, Southeastern Brazil. Climate conditions are tropical, that is, dry and mild temperatures in winter and rainy and warm temperatures in summer (CEPAGRI 2015).

Pedro Beicht Reservoir is located into the Reserva Florestal Morro Grande between the coordinates 23°39'-23°44'S and 46°57'-46°58'W. It was built in 1933, has a surface area of 2.9 km^2 and maximum depth of 10 m. Ribeirão do Campo is situated between the coordinates 23°38'-23°39'S and 45°49'-45°50'W, was built in 1958, has a surface area of 1.6 km^2 and maximum depth of 14 m. Limnological characteristics for Pedro Beicht are available in Almeida & Bicudo (2014) and for Ribeirão do Campo in the AcquaSed database Project. Both reservoirs present clean waters, acidic to slightly acidic with low conductivity and low nutrient availability. The former is oligotrophic (pH 5.4-6.6, conductivity 13-19 $\mu S\ cm^{-1}$, total phosphorus 9.8-16.5 $\mu g\ L^{-1}$, total nitrogen 125-332 $\mu g\ L^{-1}$), and Ribeirão do Campo is ultraoligotrophic with acidic waters (pH 5.2-5.6, conductivity < 13 $\mu S\ cm^{-1}$, total phosphorus < 5.2 $\mu g\ L^{-1}$, total nitrogen 230-565 $\mu g\ L^{-1}$).

Sampling and Microscopy

Sampling was carried out in three sites of Pedro Beicht and two sites from Ribeirão do Campo Reservoir, during summer and winter of 2010. Phytoplankton was collected with Van Dorn bottle and plankton net (20 µm mesh), periphyton was scraped from rocks and macrophytes and benthic samples were collected using a gravity core saving the top 2 cm sections for analyses. Nineteen samples (10 planktonic, four periphytic and five of surface sediment) were examined.

Samples were digested with concentrated H_2O_2 35% and HCl 37%. Cleaned material was diluted with deionized water and mounted on permanent slides using Naphrax® mounting medium. Optical microscopy observations and micrographs were taken using a light microscope, Zeiss Axio Imager A2, equipped with Differential Interference Contrast (DIC) and a high-resolution digital camera (MRC5). For scanning electron microscopy, small aliquots of the oxidized samples were filtered and washed with deionized water through a polycarbonate membrane filter (3 µm). Filters were mounted on aluminium stubs and coated with platinum. Micrographs were performed with a Hitachi SU–70 operated at 5 kV and 10 mm working distance. Photomicrographs were digitally manipulated and plates containing light and scanning electron microscopy images were created using CorelDraw X6.

Holotype permanent slides will be deposited at the Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo, São Paulo, Brazil (SP) and isotype slides will be deposited at an international herbarium. The type material of *Fragilaria braunii* Hustedt from the Hustedt Collection [BRM, Friedrich Hustedt Diatom Study Center, Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- and Meeresforschung, Bremerhaven, Germany], material number AM1018 (Brasilien, Lago Jurucuí, Plankton, 13.11.1947, collected by Braun, R.) was also analysed using LM and SEM.

Results

Eunotia sp. nov. 1 (Figs 1-30)

Holotype, isotype and type locality will be designated.

Light microscopy: Valves narrow lanceolate, needle-shaped, with apices subcapitate (Figs 4-6, 9-12); small specimens arched (Figs 10-12). Terminal raphe nodules very small, almost inconspicuous at each apex (Fig. 10). Valves 26.7-61.1 µm long, 1.8-3 µm wide in the middle. Striae parallel and equidistant (Fig. 5), 30-34 in 10 µm. Areolae inconspicuous. Girdle view sinuous, almost narrow rectangular (Figs 1-3). Ribbon-like colonies attached by linking spines (Fig. 13).

Scanning electron microscopy: External valve face wavy by the striation (Fig. 17). Valve mantle perpendicular to the valve face with striae interrupted by marginal spines (Fig. 19). Striae uniseriate. Areolae openings simple and rounded; can be occluded by a silica layer (Figs 17, 26), 65-70 in 10 µm. Raphe-sternum narrow with a filiform short raphe on the ventral valve mantle with distal raphe endings on the valve face (Figs 16, 18). Internal valve face with a small helictoglossa at each apex (Figs 27-28). One small rimoportula per valve at one apex (Fig. 29).

Fragilaria braunii Hustedt (Figs 31-52)

Light microscopy: Valves lanceolate, needle-shaped with apices attenuated (Figs 31-35). Valves 59-90 µm long, 2-3.2 µm wide in the middle. Striae parallel and equidistant, almost inconspicuous (Fig. 32), 31 in 10 µm. Areolae inconspicuous. Marginal spines quite evident (Fig. 32).

Scanning electron microscopy: External valve face smooth (Fig. 42); marginal spines, with an apical more developed (Figs 37-38). Striation discontinuous uniseriate (Figs 42, 50). Areolae openings small, simple and rounded (Fig. 42), 45-50 in 10 µm. Vestigial raphe internally (Figs 46-47) and externally (Figs 44-45) of each apex. One well-developed rimoportulae on each apex in the apical spine base (Figs 44, 46-47).

Discussion

Eunotia sp. nov. 1 is a distinctive eunotioid species having a 'fragilarioid' aspect with long (needle-shaped) cells, spines and a short distinct raphe at both apices. Contrarily to most *Eunotia* species, *Eunotia* sp. nov. 1 does not possess rectangular frustules in girdle view but a rather sinuous cell and is easily mistaken with other common *Fragilaria* Lyngbye sensu stricto species, mainly in light microscopy.

The new species was commonly found in the phytoplankton community and seems to be morphologically adapted for an open water existence. Only few species of *Eunotia* are considered 'true' planktonic species. Two of them were described in Siver *et al*. (2006), from

North Carolina, U.S.A., and can be part of the same complex of species presenting valve outlines like to the commonly known as *Fragilaria*. The most similar taxon to *Eunotia* sp. nov. 1 is *E. pseudofragilaria* but the presence of apices always capitated and lower striae density (29-31/10 μm) in the latter taxon differentiate them. Our specimens show apices mostly subcapitate but can also be attenuated. *Eunotia croatana* presents linear valves, also presents capitated apices and a narrow rectangular and sigmoid girdle view.

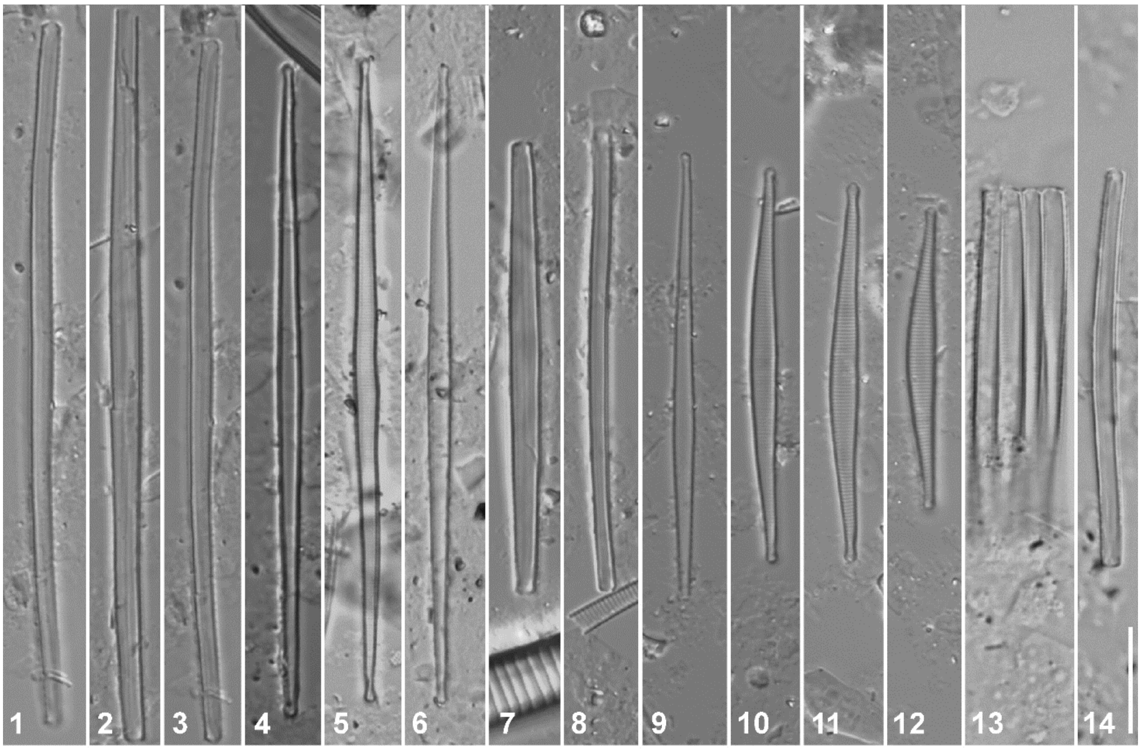
The *E. asterionelloides* species complex, some colony forming species, is also recognized by the planktonic lifeform (Wetzel *et al*. 2010). The majority of the species was described from Brazilian Amazon and differs from the new species mainly by the linear valve outline and swollen apices. Girdle view in *E. gomesii*, *E. loboi*, *E. tukanorum* and *E. waimiriorum* is larger at the apices and constricted at the center, while in *Eunotia* sp. nov. 1 the view is sinuous, almost narrow rectangular. Colonies from all these species show zigzag and radial patterns, but our specimens form ribbon-like colonies attached by linking spines as in species of *Fragilaria* (Fig. 13). *Eunotia zasuminensis*, described from Eastern Europe (Polesie) (Cabejszekówna 1937), also differs by the same features but its cordiform apices are more distinct.

Similar to species of *E. asterionelloides* complex, some *Asterionella* Hassal species from Madagascar (Bourrelly & Manguin 1949) were transfered to the genus *Actinella* by Kociolek & Rhode (1998) due to the presence of a vestigial raphe and the asymmetry in the apical and transapical axes. These *Actinella* species (*A. candelabrum*, *A. bourellyi*, *A. reviersii*) also distinguished from *Eunotia* sp. nov. 1 by the valve outline but mainly by the asymmetry in the transapical axis.

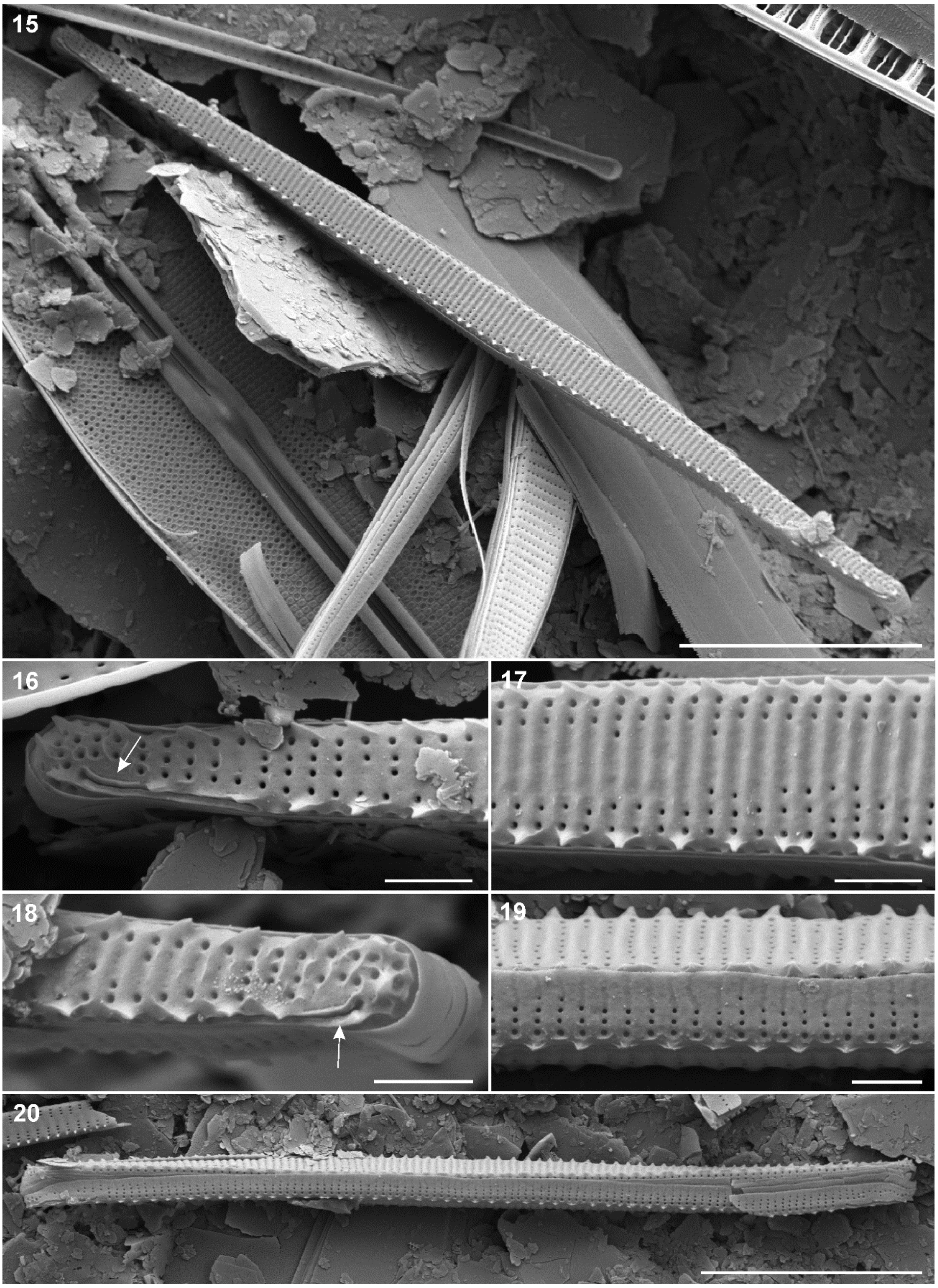
The vestigial raphe is also known in a recent genus described from Amazon, *Bicudoa* C.E. Wetzel, Lange-Bertalot & Ector that was placed in Bacillariophyceae with some similarities with *Eunotia*. Wetzel *et al*. (2012) found some rare specimens with developed raphe to specimens with vestigial raphe or absence of the slits.

Furthermore, the similarity between the new species and the concept of *Fragilaria* can be observed by the comparison with the long needle-shaped valves of *Fragilaria braunii*, species originally described from north Brazil (Amazon). Illustrations in scanning electron microscopy of its type material were provided for the first time (Figs 31-52). The population shows the characteristics spines at each apex mentioned in Hustedt (1952) and two unknown features could be observed in SEM: a vestigial raphe and a well-developed rimoportula (Figs 44-47) present in both apices of the valve.

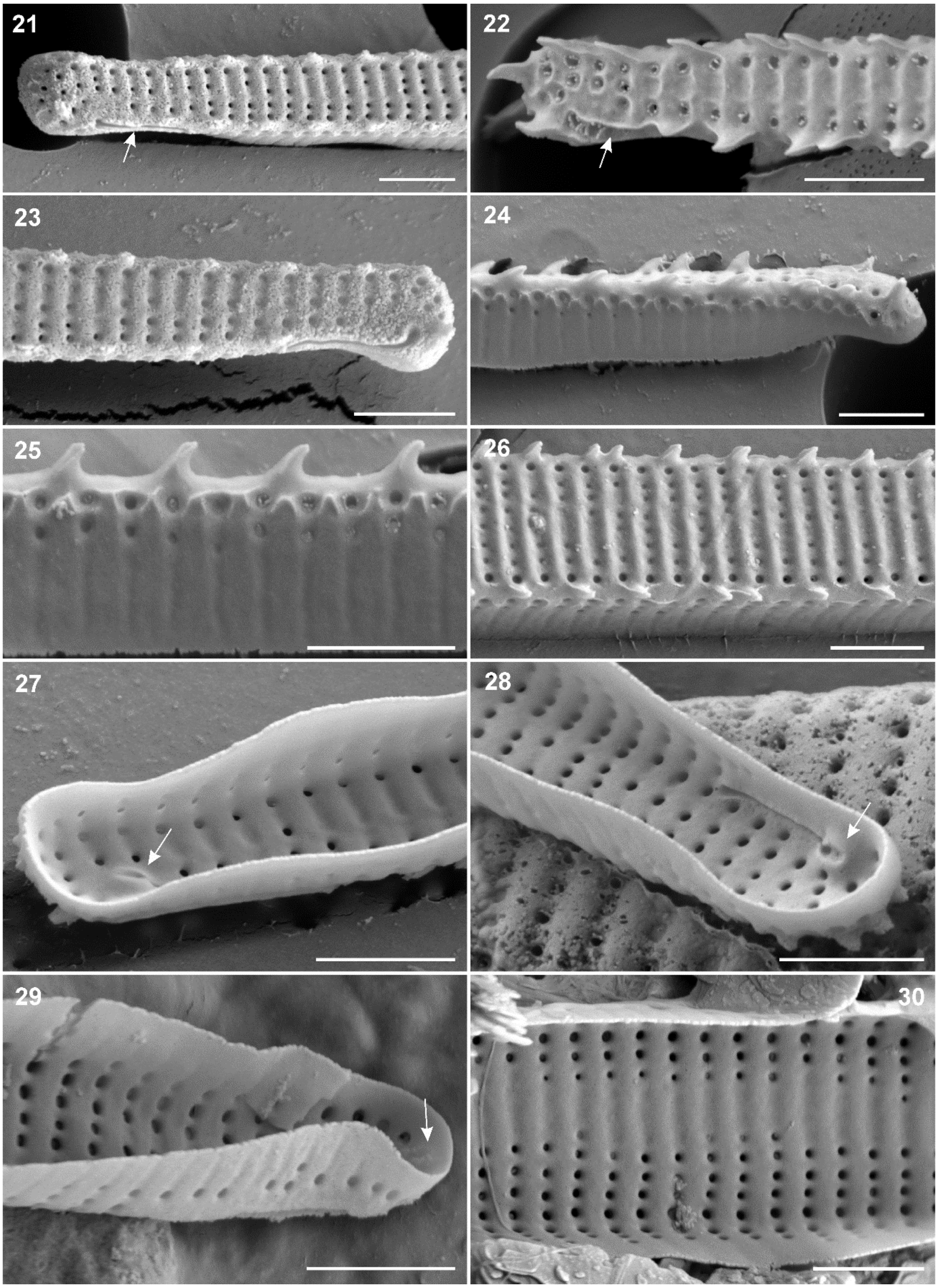
Eunotia sp. nov. 1 presents long and slender outline, only slightly asymmetrical about the apical axis with significantly reduced raphe slits and a series of siliceous ridges and spines along the valve margin. *Fragilaria braunii* is longer and symmetrical in apical and transapical axes; however it presents in each apex a small slit, probably a vestigial raphe. The marginal spines are bigger and evident in light microscopy.



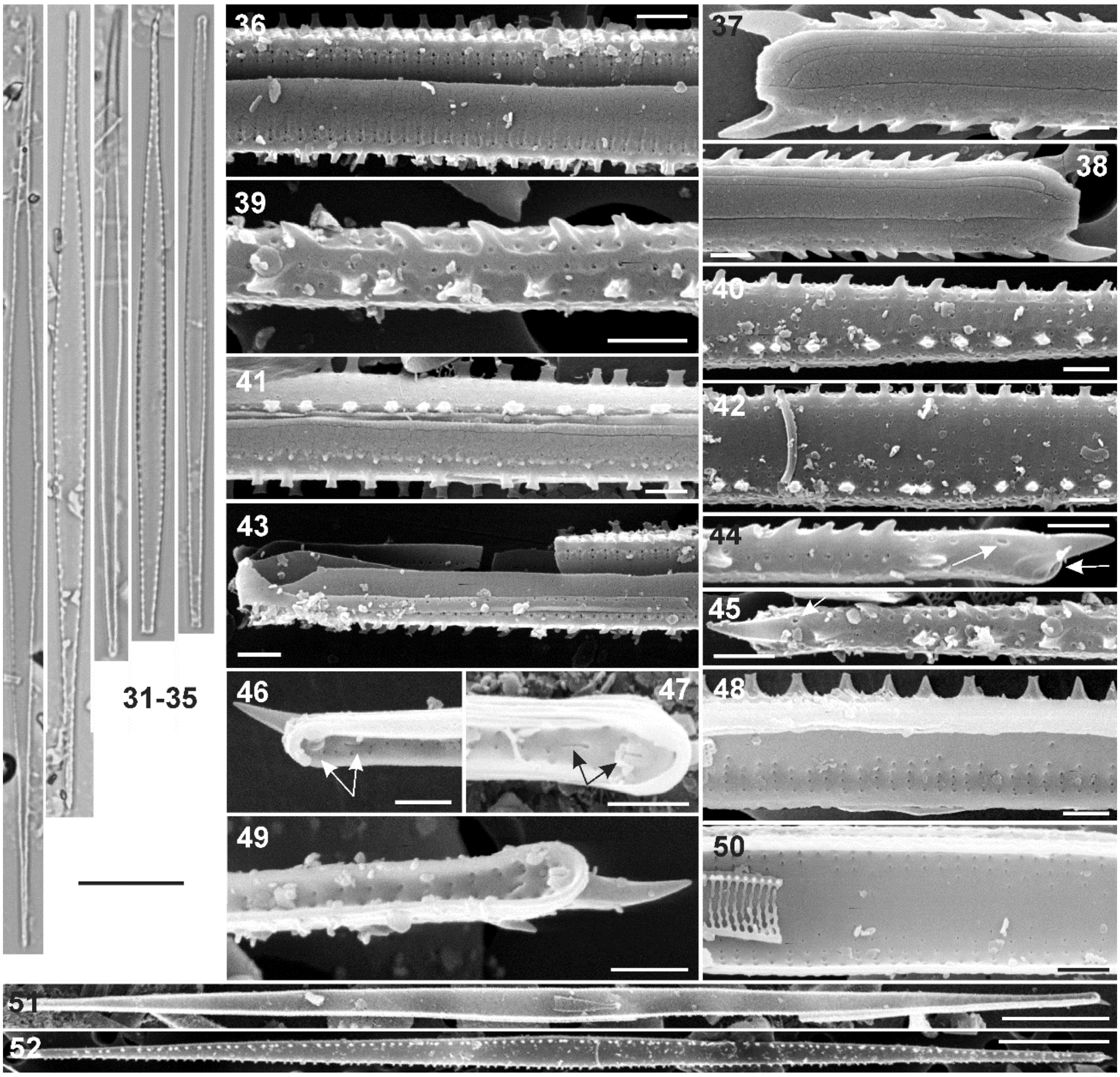
Figs 1-14. LM images of *Eunotia* sp. nov. 1 from Pedro Beicht reservoir: (4-6, 9-12) Specimens in valve view; (1-3, 7-8, 14) Specimens in girdle view; (13) Colony. Scale bar 10 µm.



Figs 15-20. SEM images of *Eunotia* sp. nov. 1 from Pedro Beicht (PB4) reservoir: (15) Specimen in external valve view; (16, 18) Apices showing the short raphe in external view; (17) External view of central area in detail; (19-20) Girdle view. Scale bars 10 µm (15, 20), 1 µm (16-19).



Figs 21-30. SEM images of *Eunotia* sp. nov. 1 from Pedro Beicht (PB4) reservoir: (21-23) External valve view of apices showing short raphe; (24) Apice in girdle view; (25) Spines in detail; (26) External view of central area in detail; (27-28) Internal view of helictoglossae in detail; (29) Internal view of rimoportula in detail; (30) Internal view of central area in detail. Scale bars 1 µm (21-30).



Figs 31-35. LM images of *Fragilaria braunii* Hustedt from type material (AM1018): (31-35) Population in valve view. Figs 36-52. SEM images of *Fragilaria braunii* Hustedt from type material (AM1018): (36-41, 43) Valve in girdle view; (42) External view of central area in detail; (44-47, 49) Apices in detail showing vestigial raphe, rimoportulae and apical spine; (48, 50) Internal view of central area in detail; (51) Specimen in internal valve view; (52) Specimen in external valve view. Scale bars 10 µm (31-35, 51-52), 1 µm (36-50).

Acknowledgements

This work was carried out within the framework of the AcquaSed project supported by funds from FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo, AcquaSed Project nº 2009/53898-9), and was undertaken as part of LFC's M.Sc. dissertation at the Instituto de Botânica - IBt (São Paulo, Brazil) (masters fellowship process n° 2014/15109-0 and BEPE process n° 2014/25311-1 to LFC). Funding was also provided by CNPq, Conselho Nacional de Desenvolvimento Científico e Tecnológico (Grant 310940/2013-3 to DCB).

Authors acknowledge the Luxembourg Institute of Science and Technology (LIST) for the support in the scanning electron microscopy. We are also grateful for the logistic support during fieldwork provided by the personnel from SABESP (Divisão de Recursos Hídricos Metropolitanos Sudoeste).

References

ALMEIDA, P.D. & BICUDO, D.C. (2014): Diatomáceas planctônicas e de sedimento superficial em represas de abastecimento da Região Metropolitana de São Paulo, SP, Sudeste do Brasil. – Hoehnea 41 (2): 182–207.

BOURRELLY, P. & MANGUIN, E. (1949): Contribution à l'étude de la flore algale d'eau douce de Madagascar: Le Lac de Tsimbazaza. – Mémoires de l'Institut Scientifique de Madagascar, Série B, 2 (2): 161–190, 7 pls.

CABEJSZEKÓWNA, I. (1937): *Fragilaria zasuminensis* n. sp. W Jeziorze Zasuminskim na Polesiu [*Fragilaria zasuminensis* n. sp. dans le lac Zasumińskie en Polésie]. – Archivum Hydrobiologii i Rybacktwa (Archives d'Hydrobiologie et d'Ichthyologie), Suwalki, 10 (4): 423–425.

CEPAGRI – Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura. (2015): A classificação climática de Koeppen para o Estado de São Paulo. – Available online at http://www.cpa.unicamp.br/outras-informacoes/clima-dos-municipios-paulistas.html; searched on September 24, 2015.

HUSTEDT, F. (1952): Neue und wenig bekannte Diatomeen. IV. – Botaniska Notiser 4: 366–410.

KOCIOLEK, J.P. & RHODE, K. (1998): Raphe vestiges in "*Asterionella*" species from Madagascar: evidence for a polyphyletic origin of the araphid diatoms? – Cryptogamie Algologie 19 (1-2): 57–74.

KOCIOLEK, J.P. (2000): Valve ultrastructure of some Eunotiaceae (Bacillariophyceae), with comments on the evolution of the raphe system. – Proceedings of the California Academy of Sciences 52 (2): 11–21.

KULIKOVSKIY, M.; LANGE-BERTALOT, H.; WITKOWSKI, A.; KHURSEVICH, G.K. & KOCIOLEK, J.P. (2015): New species of *Eunotia* (Bacillariophyta) from Lake Baikal with comments on morphology and biogeography of the genus. – Phycologia 54 (3): 248-260.

LANGE-BERTALOT, H.;BĄK, M. & WITKOWSKI, A. (2011): *Eunotia* and some related genera. In: Lange-Bertalot, H. (ed.). Diatoms of Europe. A.R.G. Gantner Verlag K.G., Ruggell, distributed by Koeltz Scientific Books, Koenigstein. 747 p.

POTAPOVA, M.G.; HAMILTON, P.B.; KOPYRINA, L.I. & SOSINA, N.K. (2014): New and rare diatom (Bacillariophyta) species from a mountain lake in Eastern Siberia. – Phytotaxa 156 (3): 100–116.
ROUND, F.E.; CRAWFORD, R.M. & MANN, D.G. (1990): The Diatoms. Biology & morphology of the genera. Cambridge University Press, Cambridge. 747 p.
SIMONSEN, R. (1979): The diatom system: Ideas on phylogeny. Bacillaria 2: 9–71.
SIVER, P.A.; HAMILTON, P.B. & MORALES, E.A. (2006): Two new planktic species of *Eunotia* (Bacillariophyceae) from freshwater waterbodies in North Carolina, U.S.A. – Algological Studies 119: 1–16.
VAN DE VIJVER, B.; DE HAAN, M. & LANGE-BERTALOT, H. (2014): Revision of the genus *Eunotia* (Bacillariophyta) in the Antarctic Region. – Plant Ecology and Evolution 147 (2): 256–284.
WETZEL, C.E.; ECTOR, L.; HOFFMANN, L. & BICUDO, D.C. (2010): Colonial planktonic *Eunotia* (Bacillariophyceae) from Brazilian Amazon: Taxonomy and biogeographical considerations on the *E. asterionelloides* species complex. – Nova Hedwigia 91 (1-2): 49–86.
WETZEL, C.E.; ECTOR, L.; HOFFMANN, L.; LANGE-BERTALOT, H. & BICUDO, D.C. (2011): Two new periphytic *Eunotia* species from the neotropical Amazonian 'black waters', with a type analysis of *E. braunii*. – Diatom Research 26 (1): 135–146.
WETZEL, C.E.; LANGE-BERTALOT, H.; MORALES, E.A.; BICUDO, D.C., HOFFMANN, L. & ECTOR, L. (2012). *Bicudoa amazonica gen. nov. et sp. nov.* (Bacillariophyta) - a new freshwater diatom from the Amazon basin with a complete raphe loss in the Eunotioid lineage. – Phytotaxa 75: 1–18.
WILLIAMS, D.M. & REID, G. (2006): Fossils and the tropics, the Eunotiaceae (Bacillariophyta) expanded: A new genus for the Upper Eocene fossil diatom *Eunotia reedii* and the recent tropical marine diatom *Amphora reichardtiana*. – European Journal of Phycology 41 (2): 147–154.

7. CAPÍTULO 2 – Taxonomy and ecology of *Eunotia* species (Bacillariophyta) in 32 southeastern Brazilian reservoirs

Lívia Franco da Costa[1], Carlos E. Wetzel[2], Horst Lange-Bertalot[3], Luc Ector[2] & Denise de Campos Bicudo[1]

[1]Instituto de Botânica, Núcleo de Ecologia, Av. Miguel Stéfano, 3687, Água Funda, São Paulo/SP, 04301-902, Brazil. livia.fcosta@hotmail.com
[2]Luxembourg Institute of Science and Technology, Environmental Research and Innovation Department (ERIN), 41 rue du Brill, L-4422 Belvaux, Luxembourg
[3]Goethe-Universität Frankfurt (Main), Biologicum, Institut für Ökologie, Evolution, Diversität, Grüneburgplatz 1, DE-60323 Frankfurt am Main, Germany

Abstract

Eunotia biodiversity is better known in the European continent and North America. Compared with the Holarctic region, occurrence and distribution of diatoms are poorly known in the continental waters of South America and tropical regions. This study provides an image-rich documentation of the morphology and ultastructure of *Eunotia* species from Southeastern Brazil, including description of new taxa and restudy of some type material. Moreover, it represents the first combination of taxonomic and ecological approaches in the study of *Eunotia* in tropical and subtropical regions, expanding the autoecological knowledge of this genus and thus contributing to its use in bioindication. The material analysed included 225 samples/slides (planktonic, periphytic, surface sediment) collected from 57 geo-referenced sites distributed in 32 reservoirs of southeastern Brazil. A total of 85 taxa were observed, among these 62 known species, 13 specific and infraspecific taxa cited for the first time in Brazil, besides 10 new taxa and 12 doubtful species, usually rare. In addition, 19 taxa had their ecological preferences (optimum) calculated for nutrients (total phosphorus and total nitrogen), pH and conductivity. We confirm the preference of the genus for clean waters (ultraoligo- to mesotrophic). However, two species (*E. rhomboidea* and *Eunotia* sp. nov. 3) were associated with eutrophic waters.

I. Introduction

Eunotia Ehrenberg is the most representative genus of family Eunotiaceae classified in the Order Eunotiales (Round *et al*. 1990). It is one of the largest genera of diatoms and many taxa were described in recent years as new to science. It is estimated at least 1,500 species world-wide for the genus (Lange-Bertalot *et al.* 2011).

These organisms are mainly characterized by possessing a simple reduced raphe system restricted to the valve poles and the presence of rimoportula (Wetzel *et al.* 2010). It is a unique freshwater genus and most diverse in dystrophic or acidic waters, found predominantly in the periphyton associated with some kind of substrate, rarely occurring in the phytoplankton (Kociolek 2000, Siver *et al*. 2006).

Knowledge of *Eunotia* biodiversity as well as diatoms in general mainly covers the European continent, with a variety of specific studies (*e.g*. Alles *et al*. 1991, Mann *et al*. 2003, Ortiz-Lerín & Cambra 2007, Kulikovskiy *et al*. 2010, Lange-Bertalot *et al*. 2011, Pavlov & Levkov 2013). In North America, these studies are also quite representative (*e.g.* Novitski & Kociolek 2005, Siver *et al*. 2006, Siver & Wolfe 2007, Edlund & Brant 2010, Hamilton & Siver 2010, Furey *et al*. 2011).

Compared with the Holarctic region, occurrence and distribution of diatoms are poorly known in the continental waters of South America (Wetzel *et al.* 2011). Controversially, *Eunotia* is best represented in the latter region than elsewhere in the world (Metzeltin & Lange-Bertalot 1998).

In Brazil, besides the Amazon region (*e.g*. Patrick 1940, Hustedt 1952, Souza-Mosimann *et al*. 1997, Kociolek 2000, Aprile & Mera 2007, Wetzel *et al.* 2010, Burliga & Kociolek 2012), knowledge of the *Eunotia* biodiversity mainly includes the south and southeast of the country. In the southern region, studies are concentrated in the states of Paraná and Rio Grande do Sul, subtropical areas (*e.g*. Fürstenberger & Valente-Moreira 2000, Tremarin *et al*. 2008, Bicca & Torgan 2009, Bicca *et al*. 2011, Garcia *et al*. 2015). In the Southeast, the specific study about *Eunotia* is scarce and the largest contributions are present in diatom surveys that includes the genus.

For the State of São Paulo, it is estimated that 90 *Eunotia* species were already reported. However, most of this information was never published. The major specific contribution for the state is the inventory of the Eunotiales of the Parque Estadual das Fontes do Ipiranga recording 15 *Eunotia* species (Bicudo *et al*. 1999). The other published species are cited in taxonomic surveys of diatoms (*e.g.* Moutinho *et al*. 2007, Fontana & Bicudo 2012, Almeida & Bicudo 2014).

Thereby, this study provides an image-rich documentation of the morphology and ultastructure of *Eunotia* species of São Paulo State, besides their general ecology and distribution patterns. New species are described and discussed and some type materials are restudied.

II. Material and Methods

1. Study area

Located in southeastern Brazil, the State of São Paulo is divided in 22 Water Resources Management Units (UGRHIs) corresponding to the drainage basins. The study area includes five of these: Piracicaba/Capivari/Jundiaí Rivers (BPCJ), Alto Tietê River (BAT), Médio Tietê River/Alto Sorocaba River (BAS), Ribeira de Iguape/Litoral Sul (RILSB) and Alto Paranapanema River (BAP) (Figure 1) with emphasis on the Alto Tietê River Basin due to its importance to the water supply of the São Paulo Metropolitan Region. Climate conditions are tropical, that is, dry and mild temperatures in winter and rainy and warm temperatures in summer (CEPAGRI 2015).

This study is part of a larger research effort, the AcquaSed Project (funded by FAPESP, process number 2009/53898-9). This project aims at the establishment of a baseline diagnosis and reconstruction of anthropogenic impacts in the Guarapiranga Reservoir, focusing on sustainability in water supply and water quality management in reservoirs of the Alto Tietê and surrounding basins. All this, with the purpose of enhancing the knowledge of the ecological quality of reservoirs of São Paulo and the use of diatoms as bioindicators. The study area includes 32 reservoirs with different limnological conditions (ultraoligo- to supereutrophic). Studies related to the project are in progress and some other have already been finished (Wengrat & Bicudo 2011, Costa-Böddeker *et al.* 2012, Almeida & Bicudo 2014, Fontana *et al.* 2014, Almeida *et al*. 2015, Wengrat *et al.* 2015).

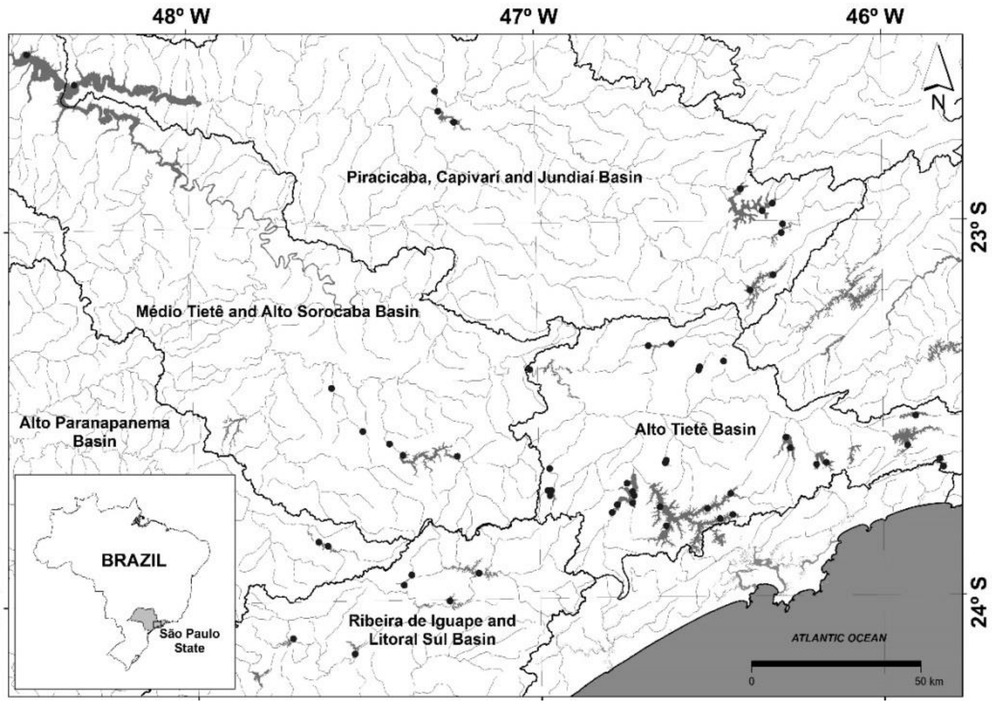


Figure 1. Geographic location of the study area and 57 sites. Gray lines represent the five watersheds included in the study.

2. Sampling

A total of 225 samples, excluding replicas, were collected from 57 geo-referenced sites (Table 1, Figure 1) distributed in 32 reservoirs. Samplings occurred from 2009 to 2014 including two climate periods (winter and summer) and covered different habitats: planktonic, periphytic and benthic. Phytoplankton was collected with Van Dorn bottle and plankton net (20 µm mesh), periphyton was scraped from rocks and macrophytes and benthic samples were collected using a gravity core using the top 2 cm sections for analyses.

Table 1. Codes and geographic coordinates of the 57 studied sites and their respective reservoirs, drainage basins, and the herbarium number of the samples analyzed. Piracicaba/Capivari/Jundiaí Rivers (PCJB), Alto Tietê River (ATB), Médio Tietê River/Alto Sorocaba River (ASB), Ribeira de Iguape/Litoral Sul (RILSB) and Alto Paranapanema River (APB).

Basins	Reservoir	Sites	Latitude (S)	Longitude (W)	Herbarium Number (SP)
APB	Paineiras	PI1	23°51'13.8"	47°36'54.8"	469212, 469425, 469445, 469492, 469503
APB	Paineiras	PI3	23°50'34.8"	47°38'26.2"	469214, 469427, 469447, 469494, 469505
ASB	Barra Bonita	BB2	22°36' 42"	48°19'14.9"	469244, 469515, 469520, 469545, 469554
ASB	Barra Bonita	BB5	22°31'56.04"	48°27'37.3"	469247, 469518, 469523, 469553, 469557
ASB	Hedberg	HB1	23º25'55.86"	47º35'33.06"	469240, 469508, 469511, 469534, 469539
ASB	Ipaneminha	IP3	23º32'34.62"	47º31'8.88"	469239, 469504, 469507, 469530

Table 1. Cont.

Basins	Reservoir	Sites	Latitude (S)	Longitude (W)	Herbarium Number (SP)
ASB	Itupararanga	IT1	23º37'11.58"	47º13'59.34"	469232, 469492, 469497, 469526
ASB	Itupararanga	IT5	23º36'53.1"	47º23'34.7"	469236, 469496, 469501
ASB	Santa Helena	SH2	23º34'58.56"	47º25'50.52"	469230, 469454, 469490, 469524, 469525
ATB	Billings (Rio Grande)	RG2	23°45'59.46"	46°30'35.7"	401560, 401572, 401584, 427898
ATB	Billings (Rio Grande)	RG4	23°43'43.74"	46°26'31.62"	401562, 401574, 401586, 427900, 427907
ATB	Billings (Rio Pequeno)	RP6	23°47'41.34"	46°28'21.66"	401564, 401576, 401588
ATB	Billings (Rio Pequeno)	RP7	23°47'1.62"	46°26'11.28"	401565, 401577, 401589, 427902, 427909
ATB	Billings (Corpo Central)	CC9	23°45'40.92"	46°38'54.06"	401567, 401579, 401591, 427903, 427910
ATB	Billings (Taquacetuba)	TQ10	23°48'44.1"	46°37'51.24"	401568, 401580, 401592, 427904, 427911
ATB	Cabuçu	CB1	23°23'25.6"	46°31'42.8"	428921, 428936, 428938, 428939, 428942
ATB	Cabuçu	CB3	23°24'0.6"	46°31'56.6"	428923, 428941
ATB	Cachoeira da Graça	CG2	23°39'17.68"	46°57'57.75"	427584, 427591, 427598, 469558

Table 1. Cont.

Basins	Reservoir	Sites	Latitude (S)	Longitude (W)	Herbarium Number (SP)
ATB	Guarapiranga	GUA1	23°46'29.76"	46°47'13.2"	469455, 469469, 428507
ATB	Guarapiranga	GUA2	23°45'17.7"	46°46'11.22"	469456, 469470, 428508
ATB	Guarapiranga	GUA6	23°45'0.72"	46°43'36.9"	469460, 469474, 428512
ATB	Guarapiranga	GUA7	23°43'38.82"	46°43'25.38"	469461, 469475, 428513
ATB	Guarapiranga	GUA8	23°42'58.14"	46°43'36.72"	469462, 469476, 428514
ATB	Guarapiranga	GUA12	23°41'53.1"	46°44'40.38"	469466, 469480, 428518
ATB	Jundiaí	JU1	23°38'50.2"	46°09'48.1"	427988, 427989, 427996, 468830, 468849
ATB	Jundiaí	JU2	23°39'07.2"	46°11'34.3"	427997, 468831, 468850
ATB	Lago das Garças	LG1	23°38'44.4"	46°37'29.9"	469483, 469484, 469485, 469486
ATB	Ninféias	NI1	23°38'19.9"	46°37'20.3"	469315, 469316, 469317, 469318, 469576
ATB	Paiva Castro	PC1	23°19'39"	46°36'42"	469259, 469281, 469303, 469369, 469379
ATB	Paiva Castro	PC4	23°19'49"	46°40'37"	469262, 469284, 469306, 469551, 469552
ATB	Paraitinga	PA1	23°31'22.0"	45°54'17.8"	427984, 427985, 427992, 427994, 468847

Table 1. Cont.

Basins	Reservoir	Sites	Latitude (S)	Longitude (W)	Herbarium Number (SP)
ATB	Pedro Beicht	PB3	23°42'58.07"	46°57'46.16"	427580, 427587, 427594
ATB	Pedro Beicht	PB4	23°43'44.06"	46°58'5.10"	427581, 427588, 427595, 469559
ATB	Pedro Beicht	PB5	23°42'55.07"	46°58'19.28"	427582, 427589, 427596, 469560
ATB	Ponte Nova	PN2	23°36'04.3"	45°55'44.04"	427923, 427926, 427983, 468845
ATB	Rasgão	RA2	23°23'28.59"	47°01'19.03"	427990, 427991, 468860
ATB	Ribeirão do Campo	RC1	23°39'31.8"	45°49'23.22"	427916, 427919, 468841
ATB	Ribeirão do Campo	RC3	23°38'15.2"	45°50'0.78"	427921, 427928, 427982, 468843
ATB	Taiaçupeba	TA1	23°36'25.9"	46°15'59.5"	427986, 427987, 468833, 468835, 468857
ATB	Taiaçupeba	TA2	23°34'40.9"	46°16'50.3"	468858
ATB	Tanque Grande	TG3	23°22'29"	46°27'31"	428920, 428926, 428929, 428932, 428935
PCJB	Atibainha	AT1	23º08'50"	46°18'49"	469253, 469275, 469297
PCJB	Atibainha	AT3	23°11'12"	46°22'51"	469255, 469277, 469299
PCJB	Cachoeira	CA2	23°00'37"	46°17'11"	469249, 469271, 469293
PCJB	Cachoeira	CA3	23°01'56"	46°17'20"	469250, 469272, 469294
PCJB	Jacareí	JC6	22°58'33.37"	46°20'39.26"	428846, 428855, 428864

Table 1. Cont.

Basins	Reservoir	Sites	Latitude (S)	Longitude (W)	Herbarium Number (SP)
PCJB	Jacareí	JC7	22°57'16.03"	46°18'52.24"	428847, 428856, 428865
PCJB	Jaguari	JA1	22°54'57.18"	46°24'19.76"	428839, 428848, 428857
PCJB	Salto Grande	SG1	22°43'43"	47°13'56"	469263, 469285, 469307, 469372, 469381
PCJB	Salto Grande	SG4	22°41'59"	47°16'33"	469266, 469288, 469310, 469375, 469384
PCJB	Tatu	TU1	22°38'42"	47°17'10"	469267, 469289, 469311, 469376, 469385
RILSB	Cachoeira da Fumaça	FU2	24°00'17.1"	47°15'44.8"	469200, 469413, 469433
RILSB	Cachoeira do França	FR3	23°55'53.4"	47°10'34.4"	469297, 469410, 469430, 469450, 469496
RILSB	Jurupará	JP1	23°56'00"	47°22'18.0"	469208, 469421, 469441, 469488, 469499
RILSB	Jurupará	JP4	23°57'36.7"	47°23'43.6"	469211, 469424, 469444, 469491, 469502
RILSB	Salto do Iporanga	SI3	24°05'54.5"	47°43'25.8"	469207, 469420, 469440
RILSB	Serraria	SE3	24°08'28.8"	47°32'32.3"	469204, 469417, 469437

3. Analysis methods

Samples were oxidized with concentrated hydrogen peroxide (H_2O_2 35%) and heating (90°C) for 24–48 h. Preparations were then allowed to cool and settle for 24 h, and 80 to 90% of the supernatant was carefully eliminated. When necessary a volume of 1 ml of HCl (37%) was then added and the mixture was allowed to stand for 2 h, followed by three rinsing and decantation using deionized water. Permanent slides were mounted with Naphrax mounting medium (Brunel Microscopes Ltd: http://www.brunelmicroscopes.co.uk/naphrax.html). For scanning electron microscopy (SEM), subsamples of the oxidized suspensions were filtered and rinsed with additional deionized water through a 3-µm Isopore™ polycarbonate membrane filter (Merck Millipore). Filters were mounted on aluminium stubs and coated with platinum using a BAL–TEC MED 020 Modular High Vacuum Coating System for 30 s at 100 mA.

Diatoms were analyzed and photographed under light (LM) and scanning electron microscopy (SEM). For LM analysis was used a binocular optical microscope, Zeiss Axio Imager A2, equipped with Differential Interference Contrast (DIC) and image capture system (MRC5). An ultra-high-resolution analytical field emission (FE) scanning electron microscope Hitachi SU–70, operated at 5 kV and with a 10 mm working distance, was used for the analysis. SEM images were taken using the lower (SE-L) detector signal. Photomicrographs were digitally manipulated and plates containing light and scanning electron microscopy images were created using CorelDraw X6.

Taxonomic analysis was based on population survey in order to record the variability of morphological and metric characteristics of each taxa. A minimum of ten valves, except for rare taxa, were measured to determine length, width and striae density of each taxon. The measurements are included in the text and plates to facilitate comparison between populations and taxa. The delimitation of the population considered the circumscription of type materials available in literature, whenever possible, and other specialized literature (*e.g.* Ehrenberg 1843, Grunow 1862, Van Heurck 1881, Migula 1907, Berg 1939, Bourrelly & Manguin 1952, Cholnoky 1955, Kobayasi *et al*. 1981, Carter & Flower 1988, Alles *et al*. 1991, Krammer & Lange-Bertalot 1991, Reichardt 1995, Lange Bertalot *et al*. 1996, 2011, Metzeltin & Lange Bertalot 1998, 2007, Kociolek 2000, Metzeltin & Lange-Bertalot 2002, Lange-Bertalot & Metzeltin 2009, Furey *et al*. 2011, Silva *et al*. 2012). All samples, including examined material selected (material with species higher abundances) and holotype material were deposited at the Herbário Científico do Estado Maria Eneyda P. Kauffmann Fidalgo, State of São Paulo, Brazil. The isotype slides will be deposited in an internacional herbarium.

At least 500 valves were counted per slide at 1000× magnification. Species abundances were expressed as a percentage of the total counts and species frequency was considered their occurrence in all sites as well as considering distinct habitats.

The ecological analysis included the assessment of the taxa ecological optimum for the variables pH, conductivity, total phosphorus and total nitrogen, available in the database of the

AcquaSed Project. The analytical methods followed standard procedures according to APHA (2005). Optima were calculated using weighted-averaging method (ter Braak & van Dam 1989, Wetzel & Ector 2014), based on species relative abundances. This method is based on the concept that the optima of a particular taxon is highest in the lakes/sites at which it achieves its highest abundance (Cumming *et al.* 2015). Only the species with frequency of occurrence equal or higher than 10% were included in the analysis.

III. Results and Discussion

A total of 85 taxa at the species (58) and variety levels (5) were identified, including 10 new species. Besides, 12 taxa were identified at the genus level. Taxonomic and ecological comments were provided and new species were described. Species are presented in alphabetical order and the plates organized in groups morphologically similar.

Division Bacillariophyta
Subdivision Bacillariophytina Medlin & Kaczmarska 2004
Class Bacillariophyceae Haeckel *emend.* Medlin & Kaczmarska 2004
Subclass Eunotiophycidae Mann *in* Round *et al.* 1990
Order Eunotiales P.C. Silva 1962
Family Eunotiaceae Kützing 1844
Genus *Eunotia* Ehrenberg 1837

Eunotia bicornigera Metzeltin & Lange-Bertalot 1998: 51-52.
[Plate 74: LM: Fig. 9]

Only one specimen was observed in the dataset, however the identification was possible due to the characteristic morphology of this taxon. Metzeltin & Lange-Bertalot (1998) compared *E. bicornigera* with *E. ventriosa* var. *brevis* (R.M.Patrick) Metzeltin & Lange-Bertalot and *E. torganiae* Metzeltin & Lange-Bertalot, but those taxa present wider valves than the species observed. The specimen found agreed with the description and illustration of the type material in all morphometric characteristics.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	27.9	7.1	15
Metzeltin & Lange-Bertalot (1998)	14-30	5-7	15-18

Examined material selected: Taiaçupeba (SP468858).

Ecological aspects: This species was described from Guyana and cited here for the first time in Brazil. In our dataset, the only specimen found occurred in a benthic sample in slightly acidic (pH 6.2) and mesotrophic (total phosphorus 26.4 µg L^{-1}) condition.

Eunotia bidens Ehrenberg 1843: 413.
[Plate 64: LM: Figs 5-9]

Two Ehrenberg species were lectotypified by Lange-Bertalot *et al*. (2011): *E. bidens* (Ehrenberg 1854, plate 2/II, fig. 31b) and *Himantidium bidens* (Ehrenberg 1854, plate 3/I, fig. 14). Lange-Bertalot *et al.* (2011) also described *H. bidens* as a new species, named *E. superbidens*, due to the impossibility of using the same specific epithet. These species were erroneously considered synonymous but they present different dimensions in all cell cycle stages. Later on, Silva *et al*. (2012) lectotypified again the first species presenting a specimen without the two visible undulations in Ehrenberg drawings, resembling *E. tropico-arcus* Metzeltin & Lange-Bertalot. The latter taxon differs from *E. biden*s exactly by the more depressed dorsal margins. Moreover, the lectotypification suggested by Silva *et al*. (2012) was disregarded due to priority issues (McNeill *et al.* 2012: Art. 11.4).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	37.3-44.9	8.7-10.5	11-13
Lange-Bertalot *et al.* (2011)	26-75	9-13	9-13

Examined material selected: Paraitinga (SP468847), Hedberg (SP469240), Guarapiranga (SP428507), Itupararanga (SP469232), Jundiaí (SP468849).

Ecological aspects: This species is one of the most frequent of the genus, being widely cited in literature from Europe, North and South America, sometimes as *E. praerupta* var. *bidens* (Ehrenberg) Grunow (*e.g.* Foged 1977, Díaz-Castro *et al.* 2003, Werum & Lange-Bertalot 2004, Tremarin *et al.* 2008, Metzeltin *et al*. 2009, Furey *et al.* 2011, Pavlov & Levkov 2013). It presents periphytic lifeform (Denys 1991) and acidophilic, oligo-mesotrophic (Van Dam *et al*. 1994) and low electric conductance (Lange-Bertalot *et al.* 2011) preferences. In our dataset, this species occurred in low abundances (< 0.5%) and low frequency (9% of all sites) in surface sediment assemblages from slightly acidic to alkaline (pH 6.2-7.6), low electric conductance (40-156 µS cm^{-1}) and meso- to eutrophic waters (total phosphorus 23.5-82.5 µg L^{-1}).

Eunotia bilunaris (Ehrenberg) Schaarschmidt 1881: 159.
[Plate 10: LM: Figs 1-7, Plate 12: SEM: 1-4]

Populations found were identified according to Lange-Bertalot *et al.* (2011), however the authors consider the concept of the *bilunaris*-complex heterogeneous. Other authors recognize the confusion in the taxonomy of the species. Vanormelingen *et al.* (2008) crossed different strains of *E. bilunaris* obtaining genetic evidences of the existence of several species in *Eunotia bilunaris* sensu lato. Thus, this taxon requires a detailed study to better recognition of its morphological variation and separation from other species.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	48.5-172	3.3-4.1	13-15
Lange-Bertalot *et al.* (2011)	14-105	3.5-5.5	13-17

Examined material selected: Taiaçupeba (SP427986, SP427987), Guarapiranga (SP428507), Billings (SP427898, SP427900), Jundiaí (SP427988), Tatu (SP469385), Pedro Beicht (SP469560), Ponte Nova (SP427983), Paiva Castro (SP469379).

Ecological aspects: Frequently cited in literature, occurred in Europe, Africa, Asia, North and South America (*e.g.* Alles *et al.* 1991, Rumrich *et al*. 2000, Kim *et al.* 2007, Faria *et al.* 2010, Furey *et al*. 2011, Pavlov & Levkov 2013). However, *E. bilunaris* presents an imprecisely known distribution due to its taxonomic confusing with similar taxa. It has been found mainly in acidic and low conductivity waters (Alles *et al*. 1991, Håkansson 1993, Taylor *et al*. 2007, Lange-Bertalot *et al*. 2011). In our dataset, it occurred in 26% of all sites with maximum abundance of 7.3%, predominantly in periphytic assemblages from low conductivity (optimum of 90 µS cm^{-1}), slightly acidic (pH optimum of 6.6) and mesotrophic waters (total phosphorus optimum of 37.2 µg L^{-1} and total nitrogen optimum of 818.9 µg L^{-1}).

Eunotia camelus Ehrenberg 1843: 413.
[Plate 71: LM: Figs 1-14, Plate 72: SEM: Figs 1-5]

Reichardt (1995) assessed and photographed the Ehrenberg type material, providing the species lectotypification. However, the type material presented a heterogeneous population composed of two different species and the lectotype designated (p. 43, fig. 4) is a similar specimen to the São Paulo populations. The name *E. camelus* has been widely cited in the literature accompanying populations with similar morphology to the other specimens presented by Reichardt (p. 43, figs 6-9, 12-13), causing more confusion within the taxon circumscription. In order to facilitate the resolution of taxonomic confusion, some populations of São Paulo of both species will be shown separately (see *Eunotia* sp. nov. 10 for differential diagnosis).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	24.2-30.8	7.3-9.5	10-14
Reichardt (1995)	22-30	6-8.8	8-12

Examined material selected: Guarapiranga (SP428507), Taiaçupeba (SP427986).

Ecological aspects: Despite this taxon being extensively reported in the literature (*e.g.* Vyverman 1991, Sala *et al*. 2002, Siver & Hamilton 2011, Bartozek *et al.* 2013), the distribution of this species is uncertain due to its taxonomic confusing with *Eunotia* sp. nov. 10. Most of the populations in these studies correspond to the latter taxon. In Ecuador, *E. camelus* is reported in acidic waters (pH 4-5.2, Oliveira & Steinitz-Kannan 1992). In our study, it occurred in low abundances (< 0.5%) and low frequency (3.5% of the sites) in slightly acidic (pH 6.3-6.7), low conductivity (14-47 µS cm^{-1}) and mesotrophic conditions (total phosphorus 25-34 µg L^{-1}).

Eunotia deficiens Metzeltin, Lange-Bertalot & García-Rodríguez 2005: 48.
[Plate 92: LM: Figs 1-8, Plate 93: SEM: Figs 1-4]

Metzeltin & Lange-Bertalot (1998) identified the taxon in Brazilian samples as *E. luna* var. *aequalis* Hustedt. Just after recognized it as a new species, published in Metzeltin *et al.* (2005). The main difference from Hustedt's taxon is the smallest size. Bicca & Torgan (2009) photographed *E. deficiens* for the first time in SEM, however the only illustration presented does not agree with the present study. Our population possess a well-developed rimoportulae and striae concentrating towards the apices, features that do not occur in specimen from Bicca & Torgan (2009).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	26.5-85.2	6.1-10.8	9-11
Metzeltin *et al.* (2005)	40-95	7.5-9.5	8-11

Examined material selected: Paiva Castro (SP469379), Paraitinga (SP427984), Salto do Iporanga (SP469420), Salto Grande (SP469372).

Ecological aspects: The species was described from Lago Calado (Amazonas) and has been found in other regions of Brazil such as Goiás (Oliveira *et al*. 2012) and Rio Grande do Sul (Bicca & Torgan 2009) in warm (21-24.4 ºC), slightly acidic (pH 6.4-6.9) and low conductivity (36-110 µS cm^{-1}) waters. In our dataset, this species mainly occurred in periphytic habitat, in 7% of all sites, and in a wide range of environmental conditions (from ultraoligotrophic to supereutrophic). However, its highest abundance (> 1%) occurred in a supereutrophic reservoir (total phosphorus 127 µg L^{-1}) with slightly alkaline pH (7.5) and high conductivity (234 µS cm^{-1}) waters.

Eunotia desmogonioides Metzeltin & Lange-Bertalot 2002: 27.
[Plate 4: LM: Figs 1-8, Plate 5: SEM: Figs 1-4, Plate 6: SEM: Figs 1-4]

Easily confused with *E. flexuosa* (Brebisson) Kützing because of its valve outline, differing by its narrower valves and higher striae density. Photos in LM of *E. flexuosa* type material are presented in Lange-Bertalot *et al.* (2011) and facilitate the species separation. According to the illustrations in Metzeltin & Lange-Bertalot (1998), *E. rabenhorstiana* var. *rabenhorstiana* (Grunow) Hustedt is also similar but its terminal raphe nodules are in different position, more distant from the apices, while in *E. desmogonioides* they are in the apices. Furthermore, *E. rabenhorstiana* var. *elongata* (R.M.Patrick) Metzeltin & Lange-Bertalot presents more inflated apices and wider valve (5-7 µm, Patrick 1940).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	63.8-114	3.3-4.8	17-19
Metzeltin & Lange-Bertalot (2002)	95-200	4.2-5	14-17

Examined material selected: Hedberg (SP469508), Ninféias (SP469317, SP469318), Paiva Castro (SP469369), Ponte Nova (SP427983), Guarapiranga (SP469455, SP469469, SP469470) Taiaçupeba (SP427987), Tatu (SP469376).

Ecological aspects: This species is only known from its type habitat (Madagascar, Metzeltin & Lange-Bertalot 2002), being presently reported for the first time in Brazil. In our dataset, *E. desmogonioides* was frequently observed (30% of all sites) in periphytic, planktonic and surface sediment assemblages, reaching higher abundance (19.8%) in periphytic samples. Considering all the assemblages the species presented its ecological optimum in slightly acidic to neutral waters (6.5-7.2), low conductivity (35-73 µS cm^{-1}) and oligo- to mesotrophic conditions (total phosphorus optimum of 15-43 µg L^{-1} and total nitrogen optimum of 368-697 µg L^{-1}).

Eunotia didyma Hustedt ex Zimmermann 1915: 51-52.
[Plate 94: LM: Figs 1-8, Plate 95: SEM: Figs 1-4]

A large gradient of forms of this species was found in our study but all corresponding to the typical variety of *E. didyma*. The polymorphism of this taxon is well known in the literature (*e.g.* Zimmermann 1915, Patrick 1940, Metzeltin & Lange-Bertalot 1998, Bicca *et al*. 2011) and because of this, *E. didyma* was separated into many varieties. Some of them published by Hustedt received a new name in Metzeltin & Lange-Bertalot (1998): *E. coringii* Metzeltin & Lange-Bertalot, *E. neomundana* Metzeltin & Lange-Bertalot, *E. elongata* (Grunow) Metzeltin & Lange-Bertalot and *E. reichardtii* Metzeltin & Lange-Bertalot.
The typical variety differs from these other species by the valves more elongated in *E. neomundana* and *E. elongata*, by the less evident median swollen less evident in *E. reichardtii* in all cell cycle stages, and differs from *E. coringii* by the more pointed apices.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	28.6-99.8	12.9-18.9	7-10
Zimmermann (1915)	50-80	15	7-10

Examined material selected: Guarapiranga (SP428507, SP469469), Paiva Castro (SP469281), Paraitinga (SP427984), Ponte Nova (SP427983).

Ecological aspects: The species has been reported in Australia, Africa, China and Cuba (*e.g.* Foged 1978, 1986, Qi & Li 2004, Toledo & Comas 2009), but mainly in Brazilian environments (*e.g.* Moreira 1975, Bicudo *et al.* 1995, Silva *et al.* 2010, Bicca *et al*. 2011, Oliveira *et al*. 2012), suggesting a tropical/subtropical distribution. In our dataset, this species occurred in 7% of all sites and reached its highest abundance (3.1%) in an oligotrophic reservoir (total phosphorus 13.7 µg L^{-1}), although also occurring in mesotrophic environments (total phosphorus 21-37.5 µg L^{-1}).

Eunotia fallacoides Lange-Bertalot & Cantonati in Cantonati & Lange-Bertalot 2011: 215.
[Plate 18: LM: Figs 7-8]

Our specimens are in accordance with the type material in all morphometric features (Cantonati & Lange-Bertalot 2011). Compared to similar species, the most different character from *E. neofallax* Nörpel-Schempp & Lange-Bertalot is the striae density, lower in this taxon (9-14/10 µm, Lange-Bertalot *et al*. 1996). *E. fallax* A. Cleve differs by its narrower valves (2-2.3 µm, Lange-Bertalot *et al*. 2011) and acutely rounded apices. *E. fallacoides* presents apices more obtusely rounded. In addition, *E. groenlandica* (Grunow) Nörpel-Schempp & Lange-Bertalot differs by its subcapitate apices but is easily confused with this species.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	26-27.9	3.1-3.3	17
Cantonati & Lange-Bertalot (2011)	16-37	2.7-4.3	15-20

Examined material selected: Jaguari (SP428857) Jurupará (SP469491).

Ecological aspects: Taxon described from the Alps, in springs, close-to-pristine and very low alkalinity habitats (Cantonati & Lange-Bertalot 2011). Its distribution is imprecisely known due to the taxonomic confusion with similar taxa (Lange-Bertalot *et al*. 2011). It is presently cited for the first time in Brazil. In our dataset, the species had low frequency (3.5% of all sites) and occurred in abundance higher than 1% in one periphytic sample, not allowing the access to its ecological preference. It occurred in neutral pH (7-7.2), low conductivity (21-36 µS cm^{-1}) and oligo-mesotrophic waters (total phosphorus 12-24.4 µg L^{-1}).

Eunotia formica Ehrenberg 1843: 414.

[Plate 97: LM: Figs 1-11, Plate 98: SEM: Figs 1-2, Plate 99: SEM: Figs 1-4]

Lange-Bertalot *et al*. (2011) selected as lectotype of this taxon a specimen marked in the Ehrenberg Collection, that is 150 µm long and 12-14 µm broad in the median region, with apical inflations, although illustrations were not provided. Despite this, these authors separated *E. formica* sensu stricto from *E. formica* sensu lato and described two similar new species. The populations found in our material were identified according their concept of *E. formica* sensu lato. *Eunotia formica* sensu stricto is wider (13 µm) and presents less striae density (6-7 in 10 µm) than the populations found in the State of São Paulo. Furthermore, *E. myrmica* presents apices cuneate and finally pointed whilst *E. formicina* presents rounded apices or little set off from the main valve body in shorter specimens. Populations from São Paulo present apices inflated and slightly cuneate in longer specimens to cuneate in shorter one.

Similar populations were found in Australia (Foged 1978), Brazil, Guyana (Metzeltin & Lange-Bertalot 1998) and Spain (Ortiz-Lerín & Cambra 2007).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	31.1-124.9	7.7-10.6	7-12
Lange-Bertalot *et al.* (2011, as *E. formica* sensu lato)	(12)20-200(230)	7-14	6-12

Examined material selected: Guarapiranga (SP428508, SP469469), Itupararanga (SP469232), Paineiras (SP469212), Paiva Castro (SP469379).

Ecological aspects: It is widespread and extensively reported in Brazil (*e.g*. Bicudo *et al*. 1995, Moutinho *et al*. 2007, Tremarin *et al*. 2008, Oliveira *et al*. 2012, Bartozek *et al*. 2013). The species is known as periphytic (Lowe 1974, Denys 1991) with wide ecological preferences, occurring in acidophilic (Patrick & Reimer 1966, Håkansson 1993, Van Dam *et al*. 1994) or circum-neutral waters (Patrick & Reimer 1966, Foged 1978) and in dystrophic to oligotrophic (Taylor *et al*. 2007), mesotrophic (Van Dam *et al*. 1994) or eutrophic environments (Guzkowska & Gasse 1990). In our study, it occurred in low frequency (9% of all sites) and abundance (maximum of 1.2%), and was found in slightly acidic to alkaline waters (pH 6.3-7.6) in a wide trophic gradient (from oligo- to eutrophic reservoirs), agreeing with the ecological range reported in literature.

Eunotia formicina Lange-Bertalot in Lange-Bertalot *et al.* 2011: 105-106.
[Plate 100: LM: Figs 1-5]

Specimens from São Paulo were rare and they were identified according to the Lange-Bertalot *et al*. (2011) concept of *E. formica* sensu lato, as commented previously. *Eunotia formicina* presents narrower valves and more striae density than *E. formica* sensu stricto, besides the rounded apices. The species presents also a slightly gibbosity at the centre in ventral margin but this feature was not presently observed. The population from Furey *et al.* (2011, pl. 18, figs 1-6) is very similar to the specimens found in São Paulo.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	98.1-163	8.2-10.1	8-12
Lange-Bertalot *et al.* (2011)	20-170	7-10	8-12

Examined material selected: Jundiaí (SP468858), Cachoeira da Graça (SP427583), Ribeirão do Campo (SP468843), Jurupará (SP469211), Guarapiranga (SP469470).

Ecological aspects: The species distribution is imprecisely known due its recent separation from *E. formica*. It is presently cited for the first time in Brazil. Lange-Bertalot *et al*. (2011) mentioned this taxon as infrequent in fens and comparable habitats that are dystrophic or oligo- to mesotrophic, moderately acidic with low to medium conductivity. In our study, the species was very rare and observed in five reservoirs (9% of all sites) mainly in surface sediment assemblages. The limnological features were from ultraoligotrophic to mesotrophic (total phosphorus < 36 µg cm^{-1}), acidic to alkaline (pH 5.4-7.9) and low conductivity (10-58 µS cm^{-1}) waters.

Eunotia fuhrmannii Metzeltin & Tremarin 2011: 203.
[Plate 107: LM: Fig. 4]

The only specimen found had more striae density as well as wider valve in the middle region than the type material. However, the characteristic morphology of this species, distinguishable from any similar taxa, allowed this identification. Metzeltin & Tremarin (2011) compared *E. fuhrmannii* with *E. brinckmannii* Metzeltin & Lange-Bertalot, however the latter had an undulated dorsal margin.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	102.2	19.3	8
Metzeltin & Tremarin (2011)	54-150	10-16	4-6

Examined material selected: Ribeirão do Campo (SP468843).

Ecological aspects: This taxon was described from southeastern Brazil (Rio de Janeiro State) in periphytic habitat and is presently cited for the second time. In our study, the species was very rare and only one specimen was found in surface sediment assemblage in acidic (pH 5.4), electrolyte-poor (10 µS cm^{-1}) and ultraoligotrophic (total phosphorus < 4 µg L^{-1}) condition.

Eunotia genuflexa Nörpel-Schempp in Lange-Bertalot & Metzeltin 1996: 50-51.
[Plate 14: LM: Figs 1-11]

Populations of *E. genuflexa* co-occurred with two similar taxa (*E. naegelii* Migula and *E. bilunaris*). *Eunotia genuflexa* can be easily distinguished from *E. naegelii* by its slightly straight to straight valves, and from *E. bilunaris* it differs by the wider valves in the latter taxon. Populations found agreed with the type material in all its morphometric characteristics.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	84.2-136.7	2.2-3	20-22
Lange-Bertalot & Metzeltin (1996)	70-160	1.5-2.6	19-23

Examined material selected: Barra Bonita (SP469545), Billings (SP427902, SP427909), Guarapiranga (SP469462, SP469466), Ninféias (SP469317, SP469318), Pedro Beicht (SP469559, SP469560), Ribeirão do Campo (SP427916).

Ecological aspects: The species was mainly reported in Europe (Hofmann *et al*. 2011, Lange-Bertalot *et al*. 2011). In southern Brazil, this taxon was reported in acidic (5.4-6.7) and low conductivity (32-110 μS cm^{-1}) waters (Bicca & Torgan 2009). In our dataset, it was mainly found in periphytic assemblages, occurring in 14% of all sites with the highest abundance of 3.9%. Its ecological preference occurred in slightly acidic (pH optimum of 6.3), low conductivity waters (optimum value of 48 μS cm^{-1}) and low nutrient conditions (total phosphorus optimum of 13.2 μg L^{-1} and total nitrogen optimum of 410.3 μg L^{-1}).

Eunotia georgii Metzeltin & Lange-Bertalot 1998: 61-62.
[Plate 77: LM: Figs 1-7]

Some specimens found in our samples presented teratological valves with more arched outline (pl. 77, figs 6-7). The most similar taxon is *E. muelleri* Hustedt in Schmidt *et al.* (1913, pl. 286, figs 9-15) which differs by the apices widely rounded. *Eunotia georgii* presents apices rounded but usually finishing with the last dorsal undulation. Type material from *E. muelleri* was observed for comparison and just one internal valve could be illustrated in SEM (pl. 78, figs 1-3).
Other closely related species such as *E. serra-australis* Metzeltin & Lange-Bertalot, *E. diadema* Ehrenberg and *E. serra* Ehrenberg differ mainly by their wider valves.

	Length (μm)	**Width (μm)**	**Striae density (in 10 μm)**
This study	47.6-75.8	7.1-11	11-14
Metzeltin & Lange-Bertalot (1998)	42-70	7-10	9-12

Examined material selected: Pedro Beicht (SP427580), Ribeirão do Campo (SP468841).

Ecological aspects: Described from Guyana, this species has also been reported in Brazil (*e.g.* Bicudo *et al*. 1999, Ferrari *et al*. 2007, Fontana & Bicudo 2012, Garcia *et al*. 2015), presenting a tropical/subtropical distribution. It occurred in low abundances (< 1%) in surface sediments assemblages in two reservoirs (3.5% of all sites) with low conductivity (10-14 μS cm^{-1}), slightly acidic (pH 5.6-6.4) and ultraoligotrophic to oligotrophic waters (total phosphorus < 14 μg L^{-1}). Both reservoirs are located in a conservation area of Atlantic Forest remnants.

Eunotia herzogii Krasske 1948: 426.
[Plate 67: LM: Figs 10-12]

Lange-Bertalot *et al.* (1996) restudied some Krasske type materials, including *E. herzogii* type. The population presently found agreed with the protologue but our small specimens presented only two undulations on the dorsal margin, resembling *E. schneideri* that, however, presents larger and more pronounced undulations. *Eunotia herzogii* is also similar to *E. bidentula* differing by its undulations even more pronounced.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	20.6-31.3	4.1-5.1	13-16
Krasske (1948) in Lange-Bertalot *et al*. (1996)	26	4	14

Examined material selected: Ribeirão do Campo (SP427916).

Ecological aspects: Besides the type locality, the species has been reported in Brazilian waters (*e.g*. Tremarin *et al*. 2008, Bicca & Torgan 2009). In our study area, it presented one of the lowest frequency (2% of all sites), occurring in low abundance (< 1%) in phytoplanktonic assemblage of an ultraoligotrophic reservoir (total phosphorus < 4 µg L^{-1}, pH 5.6 and 10 µS cm^{-1}), in agreement with previous information from southern region of Brazil (pH 6.3, conductivity 13.3 µS cm^{-1}, Bicca & Torgan 2009).

Eunotia ibitipocaensis Canani & Torgan 2013: 2-9.
[Plate 41: LM: Figs 1-19, Plate 42: SEM: Figs 1-5]

The population found agreed with the type material of Canani & Torgan (2013) with large morphological variation due to the heteropolar valves. Because of this heteropolarity, this species resembles *E. rhomboidea*, but differs because of its lower striae density. Other similar taxon is *E. siolii* Hustedt (1952: 143) that is represented here by the illustrations of the type material from Hustedt's collection (pl. 41, figs 20-28, pl. 43, figs 1-5). This taxon also presents higher striae density than *E. ibitipocaensis*, a more convex dorsal margin and more differentiated apices from the main valve body.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	14.7-30.1	3.2-5.6	5-9
Canani & Torgan (2013)	12-32.2	3-6.8	6-13

Examined material selected: Atibainha (SP469253), Ribeirão do Campo (SP468841, SP427921, SP468843).

Ecological aspects: Recently described from periphytic assemblage in very acidic waters (3.6) of southeastern Brazil (Canani & Torgan 2013) and presently reported for the second time in Brazil. In our dataset, it occurred in 5% of all sites with higher abundances (> 4%) in surface sediment, confirming its occurrence in acidic (pH 5.4-5.6), low conductivity (10-11 µS cm^{-1}) and ultraoligotrophic waters (total phosphorus < 4 µg L^{-1}).

Eunotia implicata Nörpel-Schempp, Alles & Lange-Bertalot in Alles *et al.* 1991: 206.
[Plate 27: LM: Figs 1-7, Plate 28: SEM: Figs 1-5]

The populations examined are similar to the specimens with a straight dorsal margin in Alles *et al*. (1991), but some are slightly undulated. However, other studies reported populations with more marked undulations (Vyverman *et al*. 1995, Werum & Lange-Bertalot 2004, Furey *et al*. 2011 and Lange-Bertalot *et al*. 2011).
Eunotia minor (Kützing) Grunow can be confused with *E. implicata*, but the clearest differentiation is the striae density (9-16 in 10 µm, *E. minor* in Lange-Bertalot *et al*. 2011).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	25.3-38.4	4.1-5.1	14-16
Alles *et al*. (1991)	18-30	3-5	14-20

Examined material selected: Cabuçu (SP428942), Cachoeira da Graça (SP469558), Jacareí (SP428865), Paraitinga (SP427985), Tatu (SP469311), Taiaçupeba (SP468835).

Ecological aspects: According to Buczkó & Magyari (2007), it is probably a cosmopolitan taxon, preferring oligo-dystrophic waters with low inorganic content. It was predominantly reported in Europe (Alles *et al*. 1991, Werum & Lange-Bertalot 2004, Veselá & Johansen 2009, Pavlov & Levkov 2013) but also in South and North America (Rumrich *et al*. 2000, Furey *et al*. 2011). In our dataset, the species occurred in low abundances (< 1%) in six reservoirs (10.5% of all sites) mainly from slightly acidic (5.9-6.5) but also with neutral pH (7.1) and oligo to mesotrophic waters (total phosphorus 10.5-25.9 μg cm^{-1}).

Eunotia incisa W.Gregory 1854: 96.
[Plate 22: LM: Figs 1-21, Plate 23: SEM: Figs 1-5]

This taxon is known by its terminal raphe nodules distant from the nose-like apices. Our population agreed with the type material and previous studies (*e.g.* Hein 1990, Fallu *et al*. 2000, Qi & Li 2004, Lange-Bertalot *et al*. 2011), but presents more striae density than other populations (*e.g.* Fürstenberger & Valente-Moreira 2000, Furey *et al*. 2011).
Similar species are *Eunotia incisadistans* Lange-Bertalot & Sienkiewicz that presents identical valve outline but lower striae density (11-13 in 10 μm, Lange-Bertalot *et al*. 2011), *Eunotia canicula* Furey, R.L.Lowe & J.R. Johansen and *E. incisiopsis* Metzeltin & Lange-Bertalot that present similar apices, differing by the terminal raphe nodules closer to the apices.

	Length (μm)	**Width (μm)**	**Striae density (in 10 μm)**
This study	17.9-42.7	3.2-4.4	18-21
Gregory (1854) in Lange-Bertalot *et al*. (2011)	50	5	20

Examined material selected: Billings (SP401562, SP401577, SP427909), Cachoeira da Graça (SP427584), Guarapiranga (SP469455), Pedro Beicht (SP469559, SP469560), Salto do Iporanga (SP469440).

Ecological aspects: This is a widespread species (*e.g*. Camburn & Charles 2000, Qi & Li 2004, Hofmann *et al*. 2011, Liu *et al.* 2011, Bartozek *et al.* 2013). Its environmental distribution includes upland streams with acidic, oligotrophic and electrolyte-poor waters (Taylor *et al.* 2007). In our dataset, *E. incisa* was the third most abundant species (reaching up to 53%) and occurred in 12% of all sites. However, the low frequency considering distinct habitats did not allow the access to its ecological preferences. The species was found from oligo- to eutrophic waters (total phosphorus < 71.4 μg cm^{-1}) with low to median conductivity (13-142 μS cm^{-1}) and acidic to alkaline pH (5.3-9.3). Higher abundances occurred in eutrophic conditions in disagreement with the literature.

Eunotia incisatula Metzeltin & Lange-Bertalot 1998: 62-63.
[Plate 58: LM: Figs 1-10, Plate 60: SEM: Figs 1-2]

Population examined agreed with the type material and increased the width range. Species of the *incisa*-complex (*E. incisa*, *E. incisiopsis* and *E. incisadistans*) differ from *E. incisatula* by their larger valves.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	15-30.7	2.3-3.6	13-18
Metzeltin & Lange-Bertalot (1998)	14-22	2.3-2.6	16-18

Examined material selected: Billings (SP401589), Pedro Beicht (SP427580, SP427581, SP469560), Ponte Nova (SP468845), Ribeirão do Campo (SP468841, SP427928), Salto do Iporanga (SP469207), Taiaçupeba (SP468857).

Ecological aspects: Described from Venezuela, the species is presently cited for the first time in Brazil. It occurred in six reservoirs (16% of the sites) in surface sediment assemblages with ecological preferences for slightly acidic waters (pH optimum of 5.9), low conductivity (optimum of 20 µS cm^{-1}) and low nutrient conditions (total phosphorus optimum of 9.7 µg L^{-1} and total nitrogen optimum of 335 µg L^{-1}).

Eunotia intricans Lange-Bertalot & Metzeltin 2009: 141-142.
[Plate 29: LM: Figs 1-18, Plate 30: SEM: Figs 1-7]

Population found is in accordance to the description and illustration of the type material but presents lower striae density than the material reported from São Paulo as *E. canicula* (16-22/10 µm, Fontana & Bicudo 2012). The latter taxon is a synonym of *E. intricans* as proposed in this study.
The species is very similar in valve shape to *E. parasiolii* Metzeltin & Lange-Bertalot differing by the lower striae density (6.5-11/10 µm, Metzeltin & Lange-Bertalot 1998) than our population. In contrast, *E. sioliopsis* differs by its higher striae density (16-17/10 µm, Moser *et*

al. 1998). Lange-Bertalot & Metzeltin (2009) also compared the species with populations from Brazil cited as "*E*. aff. *parasiolii*" (pl. 102, Metzeltin & Lange-Bertalot 2007), differentiating them only by the shorter cell-cycle stages. Despite this, São Paulo populations are more similar to the one found in Brazilian waters, however the differentiation between "*E*. aff. *parasiolii*" and *E. intricans* type material is not clear due to the poor representation of shorter specimens for the latter taxon. Furthermore, *E. intricans* differs from *E. telmaiana* Burliga & Kociolek, which presents apices obtusely protracted and reflexed towards the ventral margin (Burliga & Kociolek 2012).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	20.5-55.6	3.5-5.1	11-16
Lange-Bertalot & Metzeltin (2009)	17-48	4-5	11-13

Examined material selected: Cabuçu (SP428942), Guarapiranga (SP469475), Hedberg (SP469240), Jundiaí (SP427989), Paiva Castro (SP469379, SP469259), Paraitinga (SP427985), Ponte Nova (SP427983), Tanque Grande (SP428932, SP428935).

Ecological aspects: Described from Panama, it has unknown distribution due to its taxonomic confusing with similar taxa, but is associated with species found in acidic and electrolyte-poor waters (Lange-Bertalot & Metzeltin 2009). In our dataset, it was found in all the studied habitats (33% of all sites) reaching maximum relative abundance (> 19%) in a periphytic sample. The species occurred from ultraoligotrophic to supereutrophic and acidic to alkaline sites. Considering distinct habitats, *E. intrincans* presented ecological preference for slightly acidic (pH optimum range of 6.4-6.9), electrolyte-poor waters (optimum of 55-81 µS cm^{-1}) and oligo- to mesotrophic conditions (total phosphorus optimum range of 17.9-44 µg L^{-1}).

Eunotia juettnerae Lange-Bertalot in Lange-Bertalot *et al.* 2011: 127.
[Plate 11: LM: Fig 1-15]

Taxon similar to *E. bilunaris* and widespread in the study area. *Eunotia juettnerae* differs by the wider valves and lower density striae in *E. bilunaris* (Lange-Bertalot *et al.* 2011). It also differentiates from *E. naegelii* by its higher striae density (17-27 in 10 µm, Lange Bertalot *et al.* 2011).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	20.5-99.7	2.5-3.1	17-20
Lange-Bertalot *et al.* (2011)	33-104	2.7-4	16-19

Examined material selected: Guarapiranga (SP469462), Jaguari (SP428848), Jundiaí (SP427988), Ninféias (SP469317, SP469318), Paiva Castro (SP469369), Paraitinga (SP427984), Ponte Nova (SP427983), Tatu (SP469385), Ribeirão do Campo (SP427916).

Ecological aspects: It is presently cited for the first time in Brazil; however its distribution is imprecisely known due to its taxonomic confusing with *E. bilunaris*. The type material from United Kingdom was reported in low conductivity (105 µS cm^{-1}) and slightly acidic waters (6.7) (Lange-Bertalot *et al.* 2011). In our dataset, the species was the second well distributed occurring in 53% of all sites. It was mainly found in periphytic assemblage with ecological preferences for low conductivity (optimum value of 52 µS cm^{-1}), slightly acidic (pH optimum of 6.6) and mesotrophic waters (total phosphorus optimum of 23.9 µg L^{-1}, total nitrogen optimum of 533.9 µg L^{-1}).

Eunotia karenae Metzeltin & Lange-Bertalot 2007: 105.
[Plate 104: LM: Figs 1-5, Plate 105: SEM: Figs 1-3]

The species is very close by the valve outline to *E. glacialifalsa* Lange-Bertalot that presents lower striae density (4.5-7 µm, 8-11 in 10 µm, Lange-Bertalot *et al*. 2011). Considering the measurements' overlapping, isolated individuals are very difficult to identify. *Eunotia karenae* also differs from *E. glacialispinosa* Lange-Bertalot & Cantonati by the presence of polar spines in the latter species.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	101.3-148.7	6.3-7.9	10-13
Metzeltin & Lange-Bertalot (2007)	128-200	6.4-7.8	10-11

Examined material selected: Santa Helena (SP469524).

Ecological aspects: The species was only known for the type locality (Guyana) thus presently reported for the first time in Brazil. In our study, it presented one of the lowest frequency (2% of all sites) and abundances (< 1%), occurring in periphyton assemblage of neutral pH, low conductivity (105 µS cm^{-1}) and low nutrient waters (total phosphorus 12.8 µg L^{-1}).

Eunotia kruegeri Lange-Bertalot in Werum & Lange-Bertalot 2004: 152.
[Plate 54: LM: Figs 1-34, SEM: Figs 35-37]

Specimens presently found agreed with the type material, except by the variation of the striae density. They presented less rounded to widely rounded apices similar to the population in Werum & Lange-Bertalot (2004, pl. 5, figs 6-12, pl. 6, figs 15-20),
The species differs from *E. exigua* (Brébisson) Rabenhorst by the higher striae density and the apices protracted and dorsally reflexed in the latter taxon.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	10.3-18	2-3.1	20-25
Werum & Lange-Bertalot (2004)	12-15.5	2.7-3.5	25-28

Examined material selected: Atibainha (SP469275), Jurupará (SP469491), Paineiras (SP469425, SP469505), Paiva Castro (SP469281), Pedro Beicht (SP427580, SP469559, SP427581), Taiaçupeba (SP427987), Guarapiranga (SP469470).

Ecological aspects: Described from Central Europe, it is presently reported in Brazil for the first time. In our dataset, *E. kruegeri* occurred in relatively high abundances (> 4%) in five reservoirs (19% of all sites) and mainly in periphytic assemblages. It was preferably distributed in oligotrophic (total phosphorus optimum of 14.9 µg L^{-1} and total nitrogen optimum of 466.6 µg L^{-1}), low conductivity (optimum of 30 µS cm^{-1}) and slightly acidic waters (pH optimum of 6.8).

Eunotia longicollis Metzeltin & Lange-Bertalot 1998: 66.
[Plate 38: LM: Figs 1-11]

The original population (Metzeltin & Lange-Bertalot 1998, pl. 15, figs 6-8) presents large specimens, while the studied populations present a wide length range. Oliveira *et al*. (2012) had also observed smaller specimens (50-69 µm long, 7-8 µm wide) in Brazilian waters.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	28.2-72.2	6.3-7.9	9-12
Metzeltin & Lange-Bertalot (1998)	60-80	7-7.5	8-11

Examined material selected: Barra Bonita (SP469545), Hedberg (SP469534), Jundiaí (SP427989), Tatu (SP469385).

Ecological aspects: Described from Guyana, it is also known from the midwest of Brazil (Oliveira *et al*. 2012). The species was observed in periphytic assemblages presenting low frequency (7% of all sites) and maximum abundance of 7.2%. It was found from acidic to alkaline waters (pH 6.2-9.5) in wide conductivity range (46-287 µS cm^{-1}) and wide trophic gradient (total phosphorus 22.6-85.3 µg L^{-1}).

Eunotia meridiana Metzeltin & Lange-Bertalot 1998: 67-68.
[Plate 32: LM: Figs 5-14]

The examined materials are very similar to the population presented in Metzeltin *et al*. (2005) as "(?) *Eunotia meridiana*" from Uruguay and are in accordance with the type material illustrated in Metzeltin & Lange-Bertalot (1998, pl. 59, figs 8-9).
Eunotia pseudosudetica Metzeltin, Lange-Bertalot & García-Rodríguez differs from this taxon because it presents nose-like apices, higher width and striae density. Small valves of *E. incisadistans* Lange-Bertalot & Sienkiewicz are also similar to *E. meridiana* but can be distinguished by the terminal raphe nodules more distant from the apices in the first. In the study area, the species differs from *Eunotia* sp. 6 and *Eunotia* sp. 7 by the narrower valves in these two taxa and the higher striae density in the latter species.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	18.1-43.7	4.8-6.3	10-15
Metzeltin & Lange-Bertalot (1998)	12-30	4-6.5	12-15

Examined material selected: Cachoeira da Graça (SP427584), Guarapiranga (SP469470, SP428508, SP469461), Hedberg (SP469511, SP469508, SP469240), Itupararanga (SP469232), Paineiras (SP469212), Tatu (SP469289).

Ecological aspects: Described from Guyana (Essequibo River), this species is known for tropical and subtropical regions, including Brazil (*e.g.* Metzeltin & Lange-Bertalot 1998, 2007, Tremarin *et al*. 2008, Cavalcante *et al*. 2014). In our dataset, the species was observed in all assemblages (26% of all sites), presenting higher abundance (> 1%) in the surface sediment. Considering distinct habitats, the species' ecological preferences occurred in low conductivity (optimum of 66-81 µS cm^{-1}), neutral pH (7.0), and mesotrophic waters (total nitrogen optimum of 672-837 µg L^{-1} and total phosphorus optimum of 36-44 µg L^{-1}).

Eunotia mesiana Cholnoky 1955: 166.
[Plate 7: LM: Figs 1-7, Plate 8: SEM: Figs 1-5]

Krammer & Lange-Bertalot (1991) photographed the type material of *E. mesiana* presenting illustrations of valves with widely inflated (p. 510, pl. 140, figs 10, 18) and less inflated apices (p. 510, pl. 140, fig. 17), the latter shape corresponding to the Cholnoky's drawing (Cholnoky 1955). Populations from São Paulo State presented this variability and are in accordance with the type measurements. Also for Brazil, Metzeltin & Lange-Bertalot (1998) illustrated a very similar taxon but without confirming the species name (*Eunotia* (?nov.) spec, pl. 9, figs 4-7).
Eunotia desmogonioides differs by the slightly inflated to rounded and not differentiated apices from the main valve body besides the narrower valves. *E. flexuosa* and *E. corsica* Lange-Bertalot & Rol.Schmidt present more arched valves and rounded apices.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	117.8-200.4	4.7-5.2	16-17
Cholnoky (1955)	120-200	4-6	16-20

Examined material selected: Guarapiranga (SP469455), Paiva Castro (SP469369), Ponte Nova (SP427983), Tatu (SP469311, SP469289, SP469267).

Ecological aspects: Besides the type locality, this species was reported only from South Africa synonymized with *E. flexuosa* (Taylor *et al*. 2007). It is presently cited for the first time in Brazil. In our dataset, the species occurred in low abundances (< 1.5%) in 7% of all sites, whose waters are slightly acidic (pH 5.8-6.9), with low conductivity (14-63 µS cm^{-1}) and oligo to mesotrophic conditions (total phosphorus 9.3-22.5 µg L^{-1}). The only ecological information in literature considered *E. mesiana* as an acidophilic (Håkansson 1993) and oligotrophic taxon (Taylor *et al*. 2007).

Eunotia monodon Ehrenberg 1843: 126.
[Plate 103: LM: Figs 1-4]

Comments about the lectotypification of this taxon are in Lange-Bertalot *et al*. (2011). The observed populations present larger valves than the lectotype from Guadeloupe selected in Lange-Bertalot *et al*. (2011), however are in accordance to the measurements from Brazilian specimens illustrated in Metzeltin & Lange-Bertalot (1998, pl. 55, figs 6-7) which these authors considered the same taxon.
Eunotia monodon presents smaller valves than *E. metamonodon* Lange-Bertalot and *E. major* (W.Smith) Rabenhorst (types in Lange-Bertalot *et al*. 2011), and easily differs from *E. monodontiforma* Lange-Bertalot & Nörpel-Schempp by the wider valves and cuneate apices of the latter taxon.
Before the study of Lange-Bertalot *et al.* (2011), *E. monodon* was widely cited in the literature covering several different forms, being often confused with other taxa (Fungladda & Kaczmarska 1983, Cassie 1989, Bicudo *et al*. 1999, Fürstenberger & Valente-Moreira 2000, Faria *et al.* 2010, Hofmann *et al*. 2011).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	68.6-103.9	8.6-9.9	8-10
Lange-Bertalot *et al*. (2011) - lectotype	33	6.6	-
Metzeltin & Lange-Bertalot (1998) - illustrations measured in this study	48-67	8-9	10-11

Examined material selected: Guarapiranga (SP469469), Hedberg (SP469240), Paineiras (SP469212), Tatu (SP469376), Taiaçupeba (SP468857).

Ecological aspects: This is a widespread species (*e.g.* Frenguelli 1942, Foged 1977, Antoniades *et al*. 2008, Fontana & Bicudo 2012). In our dataset, it occurred in low abundances (< 1.5%) and frequency (9% of all sites) in acidic to alkaline (pH 6.3-7.6), low electric conductance waters (39-136 µS cm^{-1}) and oligo-mesotrophic to eutrophic conditions (total phosphorus 19.2-82.5 µg L^{-1}). Similar results were found in previous studies (Patrick & Reimer 1966, Håkansson 1993, Van Dam *et al*. 1994, Siver *et al*. 2005, Siver & Hamilton 2011).

Eunotia mucophila (Lange-Bertalot & Nörpel) Lange-Bertalot in Metzeltin & Lange-Bertalot 2007: 111.
[Plate 15: LM: Figs 1-20, Plate 16: SEM: Figs 1-4]

Our population agreed in all morphometric characteristics of the type material presented in Alles *et al*. (1991) and in other studies (Bicca & Torgan 2009, Hofmann *et al*. 2011 and Lange-Bertalot *et al*. 2011).
Eunotia mucophila is similar to *E. bilunaris* and *E. pararepens* Kulikovskiy, Lange-Bertalot & Witkowski but differs by its narrower valves and higher striae density. According to Kulikovskiy *et al.* (2010), *E. mucophila* is also close to *E. mongolica* Kulikovskiy, Lange-Bertalot & Witkowski and can be distinguished by the terminal raphe fissures rather long curving back from the apices in the latter taxon. In *E. mucophila* the terminal raphe fissures are short and difficult to distinguish in LM.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	16.9-58.3	2.1-2.9	21-23
Alles *et al.* (1991)	10-70	1.9-2.7(3)	20-28

Examined material selected: Billings (SP427902), Paineiras (SP469447), Pedro Beicht (SP427580, SP427588, SP427595, SP469559, SP427581, SP469560), Ribeirão do Campo (SP427916, SP427928).

Ecological aspects: Reported from Asia, Brazil, Europe and North America (*e.g.* Alles *et al*. 1991, Wojtal *et al*. 1999, Bicca & Torgan 2009, Siver & Hamilton 2011). In our data set, it occurred in high abundance (5%) in 14% of all sites with pH 5.1-6.8 and total phosphorus < 18 µg L^{-1}. Our results are in agreement with literature that report the species distribution for acidic and oligo-mesotrophic environments (Håkansson 1993, Van Dam *et al*. 1994, Siver *et al*. 2005, Siver & Hamilton 2011).

Eunotia muscicola Krasske 1939: 366.
[Plate 55: LM: Figs 12-43, Plate 57: SEM: Figs 1-3]

Close to *E. paratridentula* Lange-Bertalot & Kulikovskiy, this taxon presents ventral undulations more pronunciated, lower striae density and wider valves (18-21/10 µm, 3.3-4.7 µm, Kulikovskiy *et al*. 2010) than the present species. *Eunotia perminuta* (Grunow) R.M.Patrick presents also ventral undulations more pronunciated and lower striae density (14-19/10 µm, Patrick 1958) and is easily distinguishable.
Small specimens of *E. paramuscicola* Krstic, Levkov & A.Pavlov are also very similar, however its longer specimens can be differentiated by the number of undulations, usually higher (2-6 undulations in the entire population, Krstic *et al*. 2013) than in *E. muscicola* (2-4 undulations, Lange-Bertalot *et al.* 1996).
The observed populations are similar to the type material although some specimens presented four undulations on the dorsal margin, feature not present in the illustrations of Krasske (1939) and Lange-Bertalot *et al*. (1996). Nevertheless, Lange-Bertalot et al. (2011) and Van de Vijver *et al*. (2014) also reported variable number of dorsal undulations (2-5).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	105-15.9	2.7-3.6	20-25
Krasske (1939)	15-17	3	22

Examined material selected: Cachoeira da Fumaça (SP469200), Jurupará (SP469502, SP469491), Paineiras (SP469505), Pedro Beicht (SP427580, SP427595, SP427581), Ribeirão do Campo (SP427928, SP468843), Serraria (SP469437).

Ecological aspects: Described from Chile, the taxon was later reported from Andes, Brazil, Tasmania and Antarctic region (*e.g*. Vyverman *et al.* 1995, Rumrich *et al*. 2000, Van de Vijver *et al*. 2008, 2014, Faria *et al*. 2010). Despite its wide distribution in the Southern Hemisphere, the typical variety was often confused with its varieties. According to Van de Vijver *et al*. (2014), the species is a typical constituent of low conductivity waters (<100 µS cm^{-1}) and occurs in periphytic and sediment samples, as observed in our results. It occurred in 19% of all sites with high abundances (maximum of 17.7%) and was preferably found in slightly acidic (pH optimum of 6.2-6.8), electrolyte-poor (conductivity optimum of 22-30 µS cm^{-1}) and oligotrophic waters (total phosphorus optimum of 14-14.8 µg L^{-1}).

Eunotia naegelii Migula 1907: 203.
[Plate 13: LM: Figs 1-13]

As mentioned before, *E. naegelii* is similar to other taxa as *E. bilunaris*, *E. genuflexa* and *E. juettnerae* but differs mainly by the narrower arched valves. Some studies (Oliveira & Steinitz-Kannan 1992, Bicudo *et al*. 1999, Díaz-Castro *et al*. 2003, Qi & Li 2004, Furey *et al*. 2011) and the type material reported lower striae density (17-19/10 µm, Migula 1907) than observed in our materials, however the present population agreed with other recent literature (Lange-Bertalot *et al*. 2011, Siver & Hamilton 2011, Oliveira *et al*. 2012). Finally, the specimens illustrated as *E. naegelii* in Hein (1990), Fallu *et al*. (2000) and Siver *et al.* (2005) probably correspond to another taxon.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	39.3-90.0	1.9-2.5	21-23
Lange-Bertalot *et al*. (2011)	24-130	1.5-3	17-27

Examined material selected: Billings (SP401565, SP427902), Pedro Beicht (SP427595, SP427581, SP469560), Ribeirão do Campo (SP427919, SP427916, SP427921, SP427982, SP427928).

Ecological aspects: Widespread taxon but more frequently reported from Brazilian environments (*e.g.* Torgan 1985, Bicudo *et al.* 1999, Souza & Moreira-Filho 1999, Faria *et al*. 2010, Bicca *et al*. 2011, Oliveira *et al*. 2012). The species was reported as oligotrophe (Van Dam *et al*. 1994) and acidophilous (ter Braak & Van Dam 1989, Håkansson 1993, Van Dam *et al*. 1994). In our study, *E. naegelii* was found in 9% of all sites with slightly acidic waters (5.1-6.3) and from ultraoligotrophic to oligotrophic conditions (total phosphorus < 15.4). It occurred in all assemblages analysed, presenting the highest relative abundance in periphyton (maximum of 35.3%).

Eunotia neomundana Metzeltin & Lange-Bertalot 1998: 69-70.

[Plate 96: LM: Figs 1-4]

Synonym of *E. didyma* var. *elongata* (Grunow) Hustedt, *E. neomundana* differs from *E. didyma* var. *didyma* by its elongated valves. *E. neomundana* also resembles *E. formica* but differs because of its apical inflations less capitated and apices more apiculated. The population found in São Paulo State agreed with the type material, except for the wider apical inflations in the latter (16 µm).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	57.9-95.3	12-14.5	9-10
Metzeltin & Lange-Bertalot (1998)	80-200	16	7-9

Examined material selected: Tatu (SP469385).

Ecological aspects: Described from Brazil (Amazonas), the taxon is presently reported for the second time in Brazil. It was very rare and a small population occurred in periphyton of a mesotrophic reservoir (total phosphorus 22.6 µg L^{-1}) with slightly acidic (pH 6.3) and electrolyte-poor waters (46 µS cm^{-1}).

Desmogonium ossiculum Metzeltin & Lange-Bertalot
[Plate 2: LM: Figs 1-4, Plate 3: SEM: Figs 1-3]

This species will be transfered to *Eunotia*. All the morphometric features in *Desmogonium* can occur in *Eunotia* (*e.g.* larger valves, marginal spines, valve outline) and the differentiation of both genera is not clearly discussed in the literature, so the authors do not agree with the separation of both genera.

Similar to *E. transfuga* and other *Desmogonium* species, this species is clearly differentiated by the bone shape with strongly infated triangulate apices. Some specimens found are slightly narrower than the type material but still in accordance to the taxon.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	107.2-184.3	8.5-10.3	14-17
Metzeltin & Lange-Bertalot (2007)	120-185	10-12.5	14-15

Examined material selected: Paiva Castro (SP469379).

Ecological aspects: The species is known only from the type locality (Paraguay) and thus being reported for the first time in Brazil. In our dataset, it presented the lowest frequency of occurrence (2% of all sites) and relative abundance lower than 0.5%. The species occurred in periphythic sample of an ultraoligotrophic reservoir (total phosphorus 12.1 µg L^{-1}) with slightly acidic (pH 6.3) and electrolyte-poor waters (60 µS cm^{-1}).

Eunotia paludosa Grunow 1862: 22 (336).
[Plate 17: LM: Figs 1-10]

Five drawings were presented in the protologue of *E. paludosa* (fig. 3: 10 a-e, Grunow 1862) which were later separated by their measurements in Lange-Bertalot *et al*. (2011). The authors designated the figures c-d (ca. 20-30 µm long, 2.5-3 µm broad) as the lectotype of this taxon, and figures a-b (53 µm long, 4 µm broad) to describe the new species *E. superpaludosa* Lange-Bertalot. Populations found in São Paulo are consistent with this new concept agreeing with the morphology and measurements of several studies (Alles *et al*. 1991, Wojtal *et al*. 1999, Kulikovskiy *et al*. 2010, Bicca *et al*. 2011, Furey *et al*. 2011, Van de Vijver *et al*. 2014).
Eunotia paludosa is very similar to *E. leptopaludosa* Lange-Bertalot due the valve outline, but the latter presents narrower valves and higher striae density (1.8-2 µm, 28-30/10 µm, Lange-Bertalot *et al*. 2011).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	21.9-38.8	2.3-3.1	19-21
Lange-Bertalot *et al.* (2011)	6-53	1.8-3.5	18-25

Examined material selected: Hedberg (SP469508), Pedro Beicht (SP427581), Ribeirão do Campo (SP468841, SP468843).

Ecological aspects: The species is known from Europe, Africa, Antarctic, America (*e.g*. Alles *et al*. 1991, Wydrzycka & Lange-Bertalot 2001, Kulikovskiy *et al.* 2010, Bicca *et al*. 2011, Pavlov & Levkov 2013, Van de Vijver *et al*. 2014). It was reported as acidophilous or acidobiontic (Håkansson 1993, Van de Vijver *et al*. 2008, 2014, Lange-Bertalot *et al*. 2011). In our dataset, it was found in low abundances (< 1.5%) in 7% of all sites with slightly acidic (5.4-6.6), low to median electric conductance (10-117 µS cm^{-1}) and ultraoligo- to eutrophic conditions (total phosphorus < 80 µg L^{-1}).

Eunotia papilio (Ehrenberg) Grunow 1867: 94.
[Plate 67: LM: Figs 1-6, Plate 68: SEM: Figs 1-3]

Reichardt (1995) lectotypified *Himantidium papilio* Ehrenberg, now *Eunotia papilio* (Ehrenberg) Grunow, and presented some specimens that are very similar to ours. The species is easily distinguished from *E. pseudopapilio* Lange-Bertalot & Nörpel-Schempp by its cuneated apices and less pronunciated undulations. In Lange-Bertalot (1993), a specimen of *E. camelus* was mistenkly included in *E. papilio* complex (pl. 33, fig. 22), but it differs by the gentle subdivided undulations and rounded protracted apices.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	27.8-34.5	14.8-19.7	10-13
Reichardt (1995)	22-31	11-16	6-12

Examined material selected: Guarapiranga (SP469469), Ponte Nova (SP427983), Serraria (SP469204).

Ecological aspects: Reported from Brazil, Europe, Asia and Madagascar (*e.g.* Lange-Bertalot 1993, Metzeltin & Lange-Bertalot 1998, Metzeltin & Lange-Bertalot 2002, Ryu 2005, Oliveira *et al*. 2012). In our dataset, it was found in all studied habitats in low abundances (< 2%) and frequency (5% of all sites) from slightly to alkaline (pH 6.5-7.3) and oligo- to mesotrophic waters (total phosphorus 8.5-37.5 µg L^{-1}). In China, it occurred in more acidic waters (pH 4.8, Liu *et al*. 2011).

Eunotia parasiolii Metzeltin & Lange-Bertalot 1998: 72-73.
[Plate 27: LM: Figs 14-16]

Metzeltin & Lange-Bertalot (1998) compared this taxon with *E. siolii* Hustedt due to the similar measurements and valve outline. However, *E. parasiolii* does not present the gibbosity on the dorsal margin, feature that also distinguishes this species from *E. ibitipocaensis* Canani &

Torgan. The population examined presented higher striae density but all other morphometric characteristics such as valve outline, apices and width agreed with the type material.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	13.7-23.9	2.5-3.9	11-15
Metzeltin & Lange-Bertalot (1998)	11-37	3-5	6.5-11

Examined material selected: Serraria (SP469437, SP469204).

Ecological aspects: This species was described from Venezuela and presents a tropical distribution (*e.g*. Metzeltin & Lange-Bertalot 1998, Ferrari *et al*. 2007, Metzeltin & Lange-Bertalot 2007, Bertolli *et al.* 2010). In our study area, it presented low frequency (2% of all sites) and abundances (maximum of 2%), occurring in slightly acidic (pH 6.6-6.8), electrolyte-poor (27-28 µS cm^{-1}) and oligotrophic waters (total phosphorus 8.5-11.1 µg L^{-1}).

Eunotia paulovalida Metzeltin & Lange-Bertalot 2007: 114.
[Plate 18: LM: Figs 9-13]

The species presents almost straight valves differing from *E. valida* Hustedt that presents arched valves and apices turned to the dorsal margin. The few specimens observed totally agreed with the type material illustrated by Metzeltin & Lange-Bertalot (2007).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	40.9-77.9	4.3-5.1	12-13
Metzeltin & Lange-Bertalot (2007)	54-80	4.6-5.3	13-14

Examined material selected: Ribeirão do Campo reservoir (SP427982, SP427928, SP468843, SP427921)

Ecological aspects: Only known from the type locality (Brazil, Itatiaia Mountains) and found in bryophytes substrates, it is presently reported for the second time. In the study area, the species was very rare and found in all assemblages in low frequency (2% of all sites) in acidic (pH 5.4), electrolyte-poor (10 µS cm^{-1}) waters and ultraoligotrophic (total phosphorus < 4 µg L^{-1}).

Eunotia praerupta Ehrenberg 1843: 414.

[Plate 65: LM: Fig. 1]

Widely cited, *E. praerupta* presents a high morphological variability in the literature (Foged 1976, 1980, Hein 1990, Campeau *et al*. 1999, Fallu *et al*. 2000, Metzeltin *et al*. 2009, Liu *et al*. 2011). Lange-Bertalot *et al*. (2011) comment that two syntypes from Ehrenberg collection were photographed by R. Jahn and H. Lange-Bertalot, but a lectotype from the original habitat of the species will be designated by S. Mayama. Considering the concept of these authors and Ehrenberg's drawing of *E. praerupta*, the specimen found was easily identified.

Eunotia praerupta differs from *E. parapraerupta* Lange-Bertalot & Metzeltin that presents narrower valves (9-12 µm, Metzeltin *et al*. 2009) and from *E. superbidens* Lange-Bertalot that presents evident undulations on the dorsal margin.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	58.6	15.3	9
Lange-Bertalot *et al*. (2011)	25-90	10-17	5.5-7

Examined material selected: Jundiaí (SP468850).

Ecological aspects: This is a widespread species (*e.g*. Moreira 1975, Campeau *et al*. 1999, Tremarin *et al*. 2008, Kulikovskiy *et al*. 2010, Lange-Bertalot *et al.* 2011, Liu *et al*. 2011, Pavlov & Levkov 2013). It was very rare in our study and only one specimen was observed in surface sediments (2% of all sites) in slightly acidic (pH 6.4), electrolyte-poor (40 µS cm^{-1}) and mesotrophic condition (total phosphorus 34 µg cm^{-1}). Other studies report its occurrence in oligomesotrophic and slightly acidic waters (Foged 1978, Håkansson 1993, Van Dam *et al*. 1994).

Eunotia pseudoindica Frenguelli 1941: 307.

[Plate 85: LM: Figs 1-8, Plate 86: SEM: Figs 1-2]

Firstly described as *E. indica* (Frenguelli 1933), this species received a new name because of priority issues according to McNeill *et al.* (2012: Art. 11.4). Differs from *E. indica* Grunow by the less cuneated apices in the latter taxon, and from *E. zygodon* var. *gracilis* Hustedt by the absence of undulations on the dorsal margin. The type material presents wider valves and lower striae density, however our materials are in accordance with other Brazilian populations (Tremarin *et al*. 2008, Bicca *et al*. 2011, Canani *et al*. 2011).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	46.9-124.7	8.3-9.8	13-17
Frenguelli (1941) in Sar *et al*. (2009)	42-135	12-15	10-12

Examined material selected: Pedro Beicht (SP427580, SP427595), Guarapiranga (SP428508).

Ecological aspects: The species was described from Argentina and only reported for South America, mainly in Brazil (*e.g.* Laudares-Silva 1987, Sala *et al.* 2002, Tremarin *et al*. 2008, Bicca *et al*. 2011, Canani *et al*. 2011). In our study, the species was rare and observed in 5% of all sites with oligo- to mesotrophic conditions (total phosphorus 13.8-25.4 µg L^{-1}), slightly acidic to neutral (6.3-7) and low conductivity waters (14-50 µS cm^{-1}) in agreement with Sala *et al*. (2002, pH 6, conductivity 84 µS cm^{-1}).

Eunotia pseudosudetica Metzeltin, Lange-Bertalot & García-Rodríguez 2005: 57-58.
[Plate 31: LM: Figs 1-14, Plate 32: LM: Figs 1-4, Plate 33: SEM: Figs 1-3]

The studied populations are in accordance with the type material but are even more similar to the Brazilian populations in Metzeltin & Lange-Bertalot (1998), cited first as "*Eunotia* (?nov.) spec Nr 58:5-10" due to the more differentiated apices from the main valve body. The species can be easily confused with *E. veneris* (Kützing) De Toni, but can be distinguished mainly by the higher striae density in the latter (13-17/10 µm, Lange-Bertalot *et al*. 2011). Also similar to *E. sudetica* O. Müller, which possess wider valves (7-9 µm, Alles *et al*. 1991) and *E. intricans* Lange-Bertalot & Metzeltin that presents narrower valves (4-5 µm, Lange-Bertalot & Metzeltin 2009).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	22.9-63.8	4.8-6.8	(8)10-14
Metzeltin *et al*. (2005)	26-84	6.3-7.3	9-12

Examined material selected: Guarapiranga (SP469469, SP428508, SP469462, SP469466), Itupararanga (SP469232), Jaguari (SP428848, SP428857), Ninféias (SP469317, SP469318), Paiva Castro (SP469303).

Ecological aspects: Described from Uruguay (Metzeltin *et al*. 2005), the species is also known from Chile (Rumrich *et al.* 2000) and mainly Brazilian waters (*e.g.* Metzeltin & Lange-Bertalot 1998, Schneck *et al.* 2008, Faria *et al.* 2010, Bicca *et al*. 2011, Laux & Torgan 2011, Bartozek *et al*. 2013, Cavalcante *et al*. 2014). In our study, the species was observed in all assemblages, presenting relatively low abundances (< 4%) and the highest frequency (> 15%) in surface sediments. It presented ecological preference for low conductivity (optimum value of 50 µS cm^{-1}), slightly acidic to neutral (pH optimum of 6.9) and low nutrient waters (total nitrogen optimum of 639.8 µg L^{-1} and total phosphorus optimum of 26.1 µg L^{-1}).

Eunotia pyramidata* var. *monodon Krasske 1939: 365.
[Plate 62: LM: Figs 21-22]

Some small valves were observed in the samples analysed resembling the type material and other Brazilian populations (Lange-Bertalot *et al*. 1996, Tremarin *et al*. 2008, Bicca *et al*. 2011). Small valves of *E. pyramidata* var. *monodon*, *E. tecta* Krasske and *E. tridentula* Ehrenberg can be similar but distinguished by the number of undulations on the dorsal margin. The latter two taxa present three undulations less pronounced on the small stages and *E. pyramidata* var. *monodon* just one throughout its cell cycle.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	20.7-21.7	6.7-6.8	13-15
Krasske (1939)	16-29	5-8	-

Examined material selected: Billings (SP401589), Pedro Beicht (SP427580).

Ecological aspects: Besides the type locality, the species is well reported in Brazil mainly in periphytic habitats (*e.g*. Laudares-Silva 1987, Lyra 1971, Tremarin *et al*. 2008). In our study, it occurred in very low abundances (0.5%) in surface sediments of two mesotrophic reservoirs with acidic to slightly acidic (pH 5.2-6.4), low conductivity (14-34 µS cm^{-1}) and low total phosphorus (< 14 µg L^{-1}).

Eunotia pyramidata* var. *pryramidata* f. *capitata Krasske
[Plate 62: LM: Figs 18-20]

This taxon will be raised to species level due to the sufficient features that distinghuishes it from *E. pyramidata*. The latter taxon is a synonym of *E. tridentula*, differing from *E. pyramidata* f. *capitata* which presents more pronounced central undulation on the dorsal margin. In addition, our population presents slightly smaller and narrower valves than the type material increasing the range found by Krasske.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	25.3-26.8	5.3-6.3	12-15
Krasske (1948)	36-42	7-8	10-12

Examined material selected: Pedro Beicht (SP427581), Ribeirão do Campo (SP468843).

Ecological aspects: No ecological information was found in the literature. In our study, *Eunotia pyramidata* f. *capitata* was very rare and few specimens were observed in surface sediments assemblages of two reservoirs (3.5% of all sites) with acidic (pH 5.4-6.2) and ultra-oligotrophic to oligotrophic (total phosphorus < 15 µg L^{-1}) conditions.

Eunotia rabenhorstii* var. *monodon Cleve & Grunow in Van Heurck 1881: pl. 35, fig. 12B.
[Plate 62: LM: Fig 1-14, Plate 63: SEM: Figs 1-3]

Despite this, two other taxa, *Eunotia ernestii* Lange-Bertalot & Witkowki and *E. excelsa* (Krasske) Nörpel-Schempp, present similar valve outline but they differ by the triangular undulation more inflated on the dorsal margin in the first and mainly by the larger valves in the latter (17-68 µm long, 8-14 µm broad, Lange-Bertalot *et al*. 2011).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	11.3-23.4	5.5-7.3	12-18
Metzeltin *et al*. (2005)	14-24	7.3	13-14

Examined material selected: Atibainha (SP469253, SP469277), Guarapiranga (SP469470, SP469456), Itupararanga (SP469497), Jaguari (SP428857), Juruparà (SP469499), Paineiras (SP469503), Paiva Castro (SP469281, SP469379).

Ecological aspects: It was well reported in Brazil (*e.g*. Fürstenberger & Valente-Moreira 2000, Bertolli *et al*. 2010, Bicca *et al*. 2011, Fontana & Bicudo 2012, Oliveira *et al*. 2012, Garcia *et al*. 2015), but also occurred in North America, Papua New Guinea and Uruguay (*e.g*. Patrick & Reimer 1966, Vyverman 1991, Metzeltin *et al*. 2005, Furey *et al*. 2011). This taxon occurred in low abundances (< 1.5%) and frequency (21% of all sites) in reservoirs with a wide range of trophic status (ultraoligo- to eutrophic). It was mainly found in planktonic samples with oligo-mesotrophic (total phosphorus < 38 µg L^{-1}) and slightly acidic to alkaline waters (pH 6.2-7.3). It was previously classified as acidophilous (Foged 1978).

Eunotia rabenhorstii* var. *triodon Cleve & Grunow in Van Heurck 1881: pl. 35, fig. 12A. [Plate 62: LM: Figs 15-17]

Material observed present populations similar to others found in Brazil (Torgan 1985, Bicca *et al*. 2011, Bartozek *et al*. 2013) and Uruguay (Metzeltin *et al*. 2005), besides the type material. The taxon is very close to *E. rabenhorstii* var. *monodon* but differs by the presence of three undulations on the dorsal margin of the latter taxon. *Eunotia pyramidata* f. *capitata* Krasske is also similar but presents longer valves and more convex dorsal margin.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	26.4-28.8	6.9-7.7	11-13
Bicca *et al*. (2011)	22-23.4	6.6-7	10-13

Examined material selected: Atibainha (SP469275), Billings (SP401589), Hedberg (SP469240), Paiva Castro (SP469259), Paraitinga (SP468847), Pedro Beicht (SP427581).

Ecological aspects: Reported only from tropical and subtropical regions, including Brazil (*e.g.* Hustedt 1949, Metzeltin *et al.* 2005, Bicca *et al*. 2011, Bartozek *et al.* 2013, Garcia *et al.* 2015). In our data set, the taxon occurred in low abundances (< 1%) and low frequency (10.5% of all sites) in the surface sediments of acidic to slightly alkaline (5.2-7.6) and oligo to eutrophic (total phosphorus < 82.5 µg L^{-1}) waters. Oliveira & Steinitz-Kannan (1992) also found it in acidic waters (pH 5.2).

Eunotia rhomboidea Hustedt 1950: 435.
[Plate 45: LM: Figs 1-32, Plate 46: SEM: Figs 1-5]

This species, characteristic by its heteropolar valves and rhomboid girdle view, resembles *E. papilioforma* Furey, J.R.Johansen & R.L.Lowe that differs by the nose like apices with a more conspicuous helictoglossae than in *E. rhomboidea*. Populations from São Paulo agreed with measurements and morphology of type material and other recent literature (Silva *et al*. 2010, Furey *et al*. 2011, Hoffmann *et al*. 2011, Lange-Bertalot *et al*. 2011, Siver & Hamilton 2011) but presents wider valves than in some studies (Siver *et al*. 2005, Buczkó & Magyari 2007, Faria *et al*. 2010).
Furey *et al*. (2011) commented the presence of a rimoportula in *E. rhomboidea* as an uncommon feature observed in specimens from Great Smoky Mountains National Park (USA). Specimens from São Paulo also presented a visible rimoportula in SEM images (pl. 46. Fig. 4), indicating a more common feature than previously considered.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	19.6-28.2	3.7-5.5	15-18
Hustedt (1950)	15-20	2-4	16-18

Examined material selected: Guarapiranga (SP469475), Jundiaí (SP427996, SP427989, SP427988), Paraitinga (SP427984), Salto Grande (SP469384, SP469375, SP469266), Taiaçupeba (SP468835, SP468857).

Ecological aspects: Widely reported in the literature from all over the world (*e.g.* Foged 1976, 1977, 1978, 1984, Camburn & Charles 2000, Buczkó & Magyari 2007, Hofmann *et al.* 2011, Garcia *et al.* 2015). This species was reported as oligotrophe (Hofmann 1994, Van Dam *et al*. 1994) and acidophilous (Håkansson 1993, Van Dam *et al*. 1994). In contrast, in our dataset it was found in high abundances (maximum of 7%) and frequency (14% of all sites) in all the assemblages and preferably in eutrophic reservoirs (total phosphorus optimum of 57 µg L^{-1} and total nitrogen optimum of 864.9 µg L^{-1}) with optimum conductivity of 108 µS cm^{-1} and slightly alkaline (pH optimum of 7.3).

Eunotia roland-schmidtii Metzeltin & Lange-Bertalot 2007: 117.
[Plate 9: LM: Fig 1-6, Plate 12: SEM: Fig. 5]

The most similar taxon is *E. patrickae* Hustedt that presents nose-like apices more acute and narrower valves (2.8-3.5 µm, Metzeltin & Lange-Bertalot 2007). All morphological characteristics of population found are in accordance with the type material.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	84.1-125.7	5-6.5	11-12
Metzeltin & Lange-Bertalot (2007)	90-175	4-6	11-11.5

Examined material selected: Pedro Beicht (SP427580).

Ecological aspects: Described from Brazil (Amazonian), the taxon also occurs in Guyana (Metzeltin & Lange-Bertalot 2007). This is the second occurrence of the species in Brazil. In our study, it presented one of the lowest frequency of occurrence (2% of all sites) and low abundance (< 0.5%) in surface sediments of an oligotrophic reservoir. This site had slightly acidic pH (6.4), electrolyte-poor waters (14 µS cm^{-1}) and low phosphorus concentration (13.8 µg L^{-1}).

Eunotia schneideri Metzeltin & Lange-Bertalot 1998: 77.
[Plate 67: LM: Fig. 13]

The specimen observed in São Paulo presents higher striae density than the type material in Metzeltin & Lange-Bertalot (1998, 12 in 10 µm). *Eunotia bidentula* W.Smith, taxon compared by the authors, presents a wider range of striae density (15-20 in 10 µm), agreeing with our material. However, *E. schneideri* is more similar due to other morphometric characteristics such as lower undulations and narrower valves. Tremarin *et al*. (2008) observed striae density of 12-

14 in 10 µm in a population of southern Brazil, increasing the known range for the species. More photographs are required to document the size variation of the population in São Paulo.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	24.9	5	16
Metzeltin & Lange-Bertalot (1998)	25-40	5.3-5.6	12

Examined material selected: Pedro Beicht (SP427581).

Ecological aspects: Described from Venezuela, the taxon has been reported in Brazil (*e.g.* Ferrari *et al*. 2007, Tremarin *et al*. 2008) from planktonic and periphytic samples with acidic pH (4.4-5.3) and low conductivity (9-13 µS cm^{-1}). In our study, it was very rare and found once from the surface sediment in oligotrophic condition (total phosphorus 15 µg L^{-1}), in agreement with previous findings.

Eunotia subarcuatoides Alles, Nörpel & Lange-Bertalot 1991: 188.
[Plate 17: LM: Figs 14-30]

The species is similar to the small valves of *E. bilunaris* differing by the lower striae density (13-17 in 10 µm, Lange-Bertalot *et al*. 2011) in the latter. Another similar taxon, *E. boreotenuis* Nörpel-Schempp & Lange-Bertalot, differs by its slightly wider valves and lower striae density (15-18 in 10 µm, Lange-Bertalot & Metzeltin 1996). Besides, striae in *E. subarcuatoides* is less evident than these taxa because of the higher density.
Populations from São Paulo presented more pointed apices but still in accordance with the type.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	11.1-30.1	2.5-3.3	18-25
Alles *et al*. (1991)	4-30	3-4.5	18-22

Examined material selected: Billings (SP401586, SP427902, SP401589), Cachoeira da Fumaça (FU2I-F), Guarapiranga (SP428507, SP428508, SP428512), Pedro Beicht (SP469560), Ribeirão do Campo (SP427916).

Ecological aspects: The species presents a worldwide distribution (*e.g.* Rumrich *et al*. 2000, Metzeltin *et al.* 2005, Ortiz-Lerín & Cambra 2007, Hofmann *et al*. 2011, Pavlov & Levkov 2013), including Brazil (*e.g.* Bicca & Torgan 2009, Silva *et al*. 2010). It is considered acidophilous (Håkansson 1993) or acidobiontic (Van Dam *et al*. 1994). In our dataset, the species occurred in 14% of all sites in a wide range of pH (5.1-8.1) and trophic states from ultraoligo- to eutrophic (total phosphorus < 106 µg L^{-1}). However, highest abundances (> 20%) were reached in ultraoligotrophic sites.

Eunotia sudetica O.Müller 1898: 12.
[Plate 25: LM: Figs 15-17]

Some small specimens were found in the studied area and are in accordance to the concept of the species in Alles *et al*. (1991). Lange-Bertalot *et al*. (2011) comment the confusion between *E. sudetica* and *E. incisadistans* in the past, but the taxa can be easily separated by the narrower valves (5.5-6.5 µm) and terminal raphe nodules distant from the apices in the latter taxon. From *E. pirla* J.R.Carter & Flower the differentiation is made by the 3-undulatade ventral margin and higher striae density in this taxon (17 in 10 µm, Carter & Flower 1988).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	15.5-26.8	7.1-7.9	12-14
Alles *et al.* (1991)	(9)15-55	(5)7-9	8-13(17)

Examined material selected: Ribeirão do Campo (SP468843).

Ecological aspects: This taxon is widely cited in literature however, according to Lange-Bertalot *et al*. (2011), it is less frequent than supposed because of the taxonomic confusion with other similar taxa (*e.g*. Foged 1977, 1978, 1984, Bicudo *et al.* 1999, Camburn & Charles 2000, Hofmann *et al*. 2011). In our study, the species was very rare and a small population was found in the surface sediment of an ultraoligotrophic reservoir with low nutrient availability (total phosphorus 4 µg L^{-1}), acidic (pH 5.4) and electrolyte-poor (10 µS cm^{-1}) waters. Our results reveal an acidophilic taxon in agreement with previous studies (Foged 1978, 1983, Håkansson 1993).

Eunotia superbidens Lange-Bertalot in Lange-Bertalot *et al*. 2011: 229-230.
[Plate 64: LM: Figs 1-2, Plate 65: LM: Figs 2-4, Plate 66: SEM: Figs 1-4]

Part of the group of biggibous taxa, *E. superbidens* differs from others such as *E. bigibba* Kützing, *E. bigibboidea* Lange-Bertalot & Witkowski, *E. suecica* A.Cleve and *E. sarek* A.Berg mainly by the more depressed undulations and its larger valves.
See *E. bidens* for comments on the lectotypification and differentiation from this taxon.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	56.9-72.5	11.7-14	11-14
Lange-Bertalot *et al*. (2011)	43-90	14-19	8-15

Examined material selected: Cabuçu (SP428923).

Ecological aspects: Distribution imprecisely known due to its taxonomic confusing with *E. bidens* sensu lato and *E. praerupta* var. *bidens*. It is cited in Brazil for the first time. In our study, the species was very rare and only two specimens were observed from surface sediments in a reservoir with low nutrient availability (total phosphorus 15 µg L^{-1}), low conductivity (36 µS cm^{-1}) and pH of 6.9. Ecological preferences could not be assessed.

Eunotia tecta Krasske 1939: 364.
[Plate 69: LM: Figs 6-13, Plate 70: SEM: Figs 4-6]

The studied populations are in accordance with illustrations from the protologue and lectotype of the species provided in Lange-Bertalot *et al*. (1996). However, the population presented higher striae density.
Eunotia cordillera M.H.Hohn & Hellerman is similar to *E. tecta* and is probably a synonym (Metzeltin *et al*. 2005). From our study area, the most similar taxon is *E. tridentula* Ehrenberg which presents less evident undulations on the dorsal margin and presents the middle undulation more pronounced than the others, mainly in the smallest specimens. Furthermore, *E. tecta* also presents more pointed undulations and higher striae density.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	20.6-41.1	6.9-8.4	14-17
Krasske (1939) in Lange-Bertalot *et al*. (1996)	27-34	8-9	12-13

Examined material selected: Pedro Beicht (SP427595), Ribeirão do Campo (SP427928).

Ecological aspects: The taxon was described from Chile and it has been cited in Brazil, Uruguay, Guyana, Bolivia and Antarctic region (*e.g.* Lyra 1971, Metzeltin & Lange-Bertalot 1998, Metzeltin *et al.* 2005, Morales *et al*. 2007, Bicca *et al*. 2011, Van de Vijver *et al*. 2014). The species was observed in low abundances (< 0.5%) in periphyton and plankton assemblages of two unenriched reservoirs (3.5% of all sites). Limnological features were acidic to slightly acidic (pH 5.4-6.3), low conductivity (10-15 µS cm^{-1}) and low phosphorus content (total phosphorus < 14.5 µg L^{-1}). Both reservoirs are located in a conservation area of Atlantic Forest remnants.

Eunotia transfuga Metzeltin & Lange-Bertalot 1998: 84-85.
[Plate 1: LM: Figs 1-6, Plate 3: SEM: Figs 4-7]

The taxon was transferred to the genus *Desmogonium* Ehrenberg (1848: 539) by Metzeltin & Lange-Bertalot (2007), but the differentiation of both genera is not clearly discussed in literature, so we does not agree with the separation of both genera as previous commented.
Described from Brazil, *E. transfuga* presents long valves with marginal spines, being similar to *Actinella* taxa, however differs from these by the isopolarity of the valves. *Eunotia transfuga* was very abundant in São Paulo samples and the populations agreed with the type material increasing the range towards the smaller valves.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	75.5-167.9	5.5-8.8	15-19
Metzeltin & Lange-Bertalot (1998)	150-225	6-8	17-19

Examined material selected: Guarapiranga (SP428507, SP428508), Ninféias (SP469317), Paiva Castro (SP469379), Pedro Beicht (SP427580, SP427581), Tatu (SP469267), Taiaçupeba (SP427986).

Ecological aspects: Described from Brazil, this species has been mainly reported in this country (*e.g.* Tremarin *et al*. 2008, Bicca & Torgan 2009) but also occurred in the Colombian Amazon (Sala *et al*. 2002). In our study, the species had low frequency of occurrence (14% of all sites) and low abundances (< 1%), therefore the ecological preferences could not be assessed. It occurred in five reservoirs with low conductivity (14-60 µS cm^{-1}), mainly slightly acidic to neutral waters (5.9-7.0) and oligo to mesotrophic conditions (total phosphorus 13.8-34.0 µg L^{-1}).

Eunotia tridentula Ehrenberg 1843: 414(126).
[Plate 69: LM: Figs 1-5, Plate 70: SEM: Figs 1-3]

The population presently illustrated has three or five undulations on the dorsal margin, differing from the lectotype in Reichardt (1995) that presents only three undulations. However, five undulations only occured in the larger specimens that were not represented in Reichardt (1995). The morphological continuity within our population with larger valves besides the similar width and striae density with the lectotype allow this identification. *Eunotia quinaria* Ehrenberg differs from this species mainly by possessing five undulations on the dorsal margin also present in the smallest specimens.
Eunotia pyramidata Hustedt is a synonym of *E. tridentula* and it was frequently cited in the literature (Moreira 1975, Souza-Mosimann 1982, Torgan 1985, Rodrigues & Moreira-Filho 1990, Oliveira & Steinitz-Kannan 1992).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	24.3-57.7	7.2-8.2	11-14
Reichardt (1995)	28-41.5	7.2-9	12-14

Examined material selected: Atibainha (SP469253), Paineiras (SP469212), Pedro Beicht (SP427580, SP427595, SP427581, SP469560), Ribeirão do Campo (SP468843).

Ecological aspects: Reported from South America (*e.g*. Metzeltin & Lange-Bertalot 1998, 2007, Metzeltin *et al*. 2005, Faria *et al*. 2010, Fontana & Bicudo 2012). The taxon was found in low abundances (< 0.5%) in four studied reservoirs with ultraoligo- to oligo-mesotrophic conditions. Limnological features were acidic to slightly acidic (5.4-6.8), low conductivity (10-39 µS cm^{-1}) and low phosphorus content (< 20.3 µg L^{-1}).

Eunotia trigibba Hustedt in Schmidt *et al*. 1913: pl. 286, figs 16-18.
[Plate 67: LM: Fig. 7, Plate 68: SEM: Figs 4-5]

Similar to other tri-undulated taxa, *E. trigibba* differs from *E. triodon* Ehrenberg (25-110 µm long, 13-22 µm width, 15-18 striae in 10 µm, Lange-Bertalot *et al*. 2011) and from *E. semicircularis* (Ehrenberg) Lange-Bertalot & Metzeltin (35-60 µm long, 15-20 µm width, 14-16 striae in 10 µm, Lange-Bertalot *et al*. 2011) by the larger valves and denser striae in these two species. *Eunotia tridentula* presents more pronounced central undulation, and *E. tecta* presents higher striae density and narrower valves than *E. trigibba* (see *E. tecta* above).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	32.8	12.3	9
Patrick (1940)	34-35	11	7-11

Examined material selected: Pedro Beicht (SP427581).

Ecological aspects: The species was reported in tropical regions (Oliveira & Steinitz-Kannan 1992, Metzeltin & Lange-Bertalot 1998), but mainly in tropical and subtropical regions of Brazil: North region (Patrick 1940), Northeastern (Souza *et al.* 2007), Southern (Tremarin *et al.* 2008) and Midwest region (Oliveira *et al*. 2012). Similar specimen found in the state of São Paulo was illustrated in Bicudo *et al.* (1999) as *E. triodon*. This species presented one of the lowest frequency (2% of all sites), occurring in low abundance (< 0.5%) in surface sediment assemblage of one reservoir, that had slightly acidic (6.2), electrolyte-poor (14.1 µS cm^{-1}) waters and low nutrient availability (total phosphorus 15 µg L^{-1} and total nitrogen 163 µg L^{-1}).

Eunotia tukanorum C.E. Wetzel & D.C. Bicudo in Wetzel *et al*. 2010: 58.
[Plate 49: LM: Figs 1-15]

Eunotia tukanorum is part of a species complex of planktonic *Eunotia* described from Brazil. Because of the similar morphometric features, populations from São Paulo were easily compared and associated with the type material (pl. 49, figs 8-15), in spite of the lower striae density observed.

This taxon is difficult to differentiate mainly from *E. loboi* C.E.Wetzel & Ector due to the similar valve outline and measurements. However, *E. tukanorum* presents less rounded and wider apices, besides the terminal raphe nodules less conspicuous than in *E. loboi*. *Eunotia tukanorum* can also be compared with *E. waimiriorum* C.E.Wetzel that presents narrower valves (1.8-2.2 µm, Wetzel *et al*. 2010), and with *E. asterionelloides* Hustedt that presents less arched valves and more capitated apices.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	14.4-27.8	2.5-3.3	19-22
Wetzel *et al*. (2010)	9.2-30.3	2.6-3.7	23-27

Examined material selected: Ribeirão do Campo (SP427916).

Ecological aspects: Described from northern Brazil (Negro River, Amazonian) in acidic and electrolyte-poor waters (pH 4, 12 mS cm^{-1}, Wetzel *et al*. 2010), it was also cited in southeast of the country (Laux & Torgan 2011). The species presented one of the lowest frequency (2% of all sites) in our dataset, occurring in higher abundance (> 5%) in planktonic assemblage of an ultraoligotrophic reservoir, in agreement with the limnological features of the type locality. This reservoir presented acidic (pH 5.6) and low conductivity waters (10 µS cm^{-1}) and low nutrient availability (total phosphorus < 4 µg L^{-1} and total nitrogen 400 µg L^{-1}).

Eunotia valida Hustedt 1930: 178.

[Plate 18: LM: Figs 1-4]

The observed population in São Paulo presented narrower valves than the type material photographed by Mayama (1997). However, Lange-Bertalot *et al*. (2011) expanded the minimum width range (4-6 µm) showing a population of slender valves from Italy (pl. 213, figs 1-12). Also for Uruguay, Metzeltin *et al*. (2005) illustrated narrower specimens (3.8 µm) with few higher striae density (14-16 in 10 µm).

Furey *et al.* (2011) described two species morphologically close to *E. valida*. *Eunotia obliquestriata* Furey, R.L.Lowe & J.R.Johansen differs mainly by the apices not dorsally curved, and *E. mydohaimasiae* Furey, R.L.Lowe & J.R.Johansen by the obliquely slanted striation. Yet, Mayama (1997) described a new species, *E. pseudovalida* Mayama, only distinguished by its transapical narrow ditch in the inner valve surface and the girdle structure.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	44.6-73.1	3.7-4.5	14-18
Mayama (1997)	39-105	4.5-8	11-15

Examined material selected: Pedro Beicht (SP427580), Ribeirão do Campo (SP468841).

Ecological aspects: This is a widespread species, occurring mainly in the Holartic region (*e.g.* Hein 1990, Kulikovskiy *et al*. 2010, Furey *et al*. 2011, Hofmann *et al*. 2011). It occurs in oligotrophic to dystrophic waters, with moderate pH and low specific conductivity (Hofmann 1994, Lange-Bertalot *et al*. 2011). In our study area, the taxon was found in low abundances (< 0.5%) from two unenriched reservoirs (3.5% of all sites), with ultraoligo- and oligotrophic conditions. Limnological features were acidic to slightly acidic (pH 5.4-6.3), low conductivity (10-15 µS cm^{-1}) and low phosphorus content (< 13.8 µg L^{-1}). Both reservoirs are located in a conservation area of Atlantic Forest remnants.

Eunotia veneris (Kützing) De Toni 1892: 794.
[Plate 24: LM: Figs 1-16, Plate 25: LM: Figs 1-14, Plate 26: SEM: Figs 1-5]

Some specimens from São Paulo presented narrower valves than the type material of Asphaltsee (Pitch Lake) on island Trinidad (Republic of Trinidad and Tobago) illustrated in Krammer & Lange-Bertalot (199l, pl. 163, figs 14-19) but agreed with other Brazilian populations (Patrick 1940, Ferrari *et al*. 2007, Tremarin *et al*. 2008). They are also very close to the two populations from Guyana illustrated in Lange-Bertalot & Metzeltin (1998, pl. 60, figs 1-9).
Lange-Bertalot *et al*. (2011) pointed out the difficulty to separate *E. veneris* from *E. pirla*, but the latter taxon always presents three undulations on the ventral margin of the valve, while *E. veneris* can present ventral margins straight or slightly concave. *Eunotia carolina* R.M.Patrick is also very similar but differs by the totally straight ventral margin. From *E. incisa*, the most

obvious difference is the terminal raphe nodules distant from the apices, feature that never seen in *E. veneris*.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	15.3-73.1	4.5-7.2	13-19
Lange-Bertalot *et al*. (2011)	20-50	6-7	13-17

Examined material selected: Billings (SP401565, SP401577, SP427902, SP401589), Pedro Beicht (SP427581, SP469560), Ribeirao do Campo (SP427916, SP468841, SP427928, SP468843).

Ecological aspects: The species has been cited in Holarctic and Tropics (*e.g*. Metzeltin & Lange-Bertalot 2002, Metzeltin *et al*. 2005, Furey *et al*. 2011) however, Lange-Bertalot *et al*. (2011) disagree that *E. veneris* really exists in Europe. It was reported as an acidophilic and oligotrophic species (Håkansson 1993, Van Dam *et al*. 1994). In our dataset, the species was found in higher abundances (maximum of 13.6%) mainly occurring in surface sediment assemblages of three reservoirs (14% of all sites). Its ecological preference occurred in acidic (pH optimum of 5.5), low conductivity (optimum of 20 µS cm^{-1}) and unenriched waters (total phosphorus optimum of 6.0 µg L^{-1} and total nitrogen optimum of 352 µg L^{-1}).

Eunotia vixexigua Metzeltin & Lange-Bertalot 2007: 129-130.
[Plate 55: LM: Figs 44-54]

Described from Brazil, *E. vixexigua* is characterized by its small reniform valves with obtusely rounded apices. The São Paulo populations presented lower striae density and higher lengths than the type material, however these differences are very small. The valve outline is very similar, mainly if compared with the largest specimen of the type and the smallest specimen found, both with similar measurements.

Metzeltin & Lange-Bertalot (2007) commented the difference between the taxon and other similar species such as *E. fastigiata* Hustedt, that presents larger valves (up to 25 µm long, 3.5-4.5 µm wide), *E. exigua* (Brébisson) Rabenhorst with apices dorsally reflexed, and *E. levistriata* Hustedt with broader valves and higher striae density (15-30/10 µm).

Population of *E. subarcuatoides* from Macedonia are very similar to *E. vixexigua* although it presents lower striae density (14-16/10 µm, Pavlov & Levkov 2013). Furthermore, the type material of *E. subarcuatoides* differs by the more convex dorsal valve margin and broader valves (3-4.5 µm, Alles *et al*. 1991) than *Eunotia vixexigua*.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	14-18.2	2.9-3.4	19-21
Metzeltin & Lange-Bertalot (1998)	8-15	2.3-3.3	21-24

Examined material selected: Guarapiranga (SP428507, SP469470), Taiaçupeba (SP427986, SP427987), Tanque Grande (SP428932), Paineiras (SP469503).

Ecological aspects: Described from Brazil, the species is cited for the second time in the country. In our dataset, the taxon was found predominantly in periphytic assemblages (9% of all sites) but also in surface sediments, always in low abundances (< 0.5%). The sites presented slightly acidic (6.2-6.6), low electric conductance (41-53 µS cm^{-1}) and low phosphorus content (15.3-36 µg L^{-1}) waters.

Eunotia waimiriorum C.E.Wetzel in Wetzel *et al*. 2010
[Plate 51: LM: Figs 1-21, 29-36, Plate 52: LM: Figs 1-35, Plate 53: SEM: Figs 1-5]

Wetzel *et al.* (2010: 56 and 57) described two colonial planktonic species *E. gomesii* and *E. waimiriorum* from Brazilian Amazon, distinguishing them by the rounded capitated apices and smaller valves in *E. waimiriorum*. However, populations of both species always co-occurred showing intermediary forms of the apices. Therefore, the synonymization of both taxa will be proposed and then the length and striae density ranges will be expanded encompassing the populations found in São Paulo.
The mainly difference among the taxa closely related to *E. waimiriorum* is the apices shape. *Eunotia waimiriorum* presents rounded capitate to slightly rectangular apices, while *E. asterionelloides* Hustedt presents more capitate apices and slightly curved to the ventral side, *E. zasuminensis* (Cabejszckówna) Körner presents heart-shaped apices and *E. loboi*, bluntly rounded apices.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	13.3-47	1.5-3	15-22
Wetzel *et al.* (2010)	15.2-25.8	1.8-2.2	22-24

Examined material selected: Jundiaí (SP468831, SP468850), Ponte Nova (SP427923, SP427983, SP468845), Taiaçupeba (SP468835, SP468833, SP427987, SP427986, SP468858).

Ecological aspects: This is a poorly known species, described from Brazil (Amazonian, Branco River) in slightly acidic waters (pH 6.6, Wetzel *et al*. 2010) and presently reported for the second time. In our dataset, it was the most abundant species (maximum abundance 69.5%), occurring in nine reservoirs (24.5% of all sites), preferably in surface sediment assemblages. Despite the wide range of occurrence in different trophic conditions (oligotrophic to eutrophic) and pH (6.2-8.1), the species reached its ecological preference, considering distinct habitats, in mesotrophic (total phosphorus optimum of 24-37.3 µg L^{-1} and total nitrogen optimum of 534-736 µg L^{-1}), slightly acidic (optimum pH of 6.4-6.9), and low conductivity (41-56 µS cm^{-1}) waters.

Eunotia xystriformis Manguin in Bourrelly & Manguin 1952: 49.
[Plate 87: LM: Figs 1-9, Plate 88: SEM: Figs 1-2, Plate 89: SEM: Figs 1-4]

The observed material from São Paulo State presented narrower valves than the protologue of the species. However, measurements done in figures from the type material in Metzeltin & Lange-Bertalot (2007) showed measurements in accordance to the São Paulo specimens (7.8-11 µm wide).
The most similar taxon from the studied area is *E. pseudoindica* that presents more cuneate apices. Furthermore, *Eunotia zizkae* Metzeltin & Lange-Bertalot mainly differs by the rounded obtuse apices protracted and deflected to the ventral side, and *Eunotia platyvalva* Burliga & Kociolek by its higher striae density (18-20 in 10 µm, Burliga & Kociolek 2012).

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	51.9-88.7	7.6-11.3	13-17
Bourrelly & Manguin (1952)	57.5-112	11.5-15	13-16

Examined material selected: Taiaçupeba (SP427987), Pedro Beicht (SP427581).

Ecological aspects: Described from acidic environments (pH 4-6.5) in Guadeloupe, only known from type locality (Bourrelly & Manguin 1952). It is presently cited for the first time in Brazil. In our study, this species was very rare however, a population was observed in periphyton and surface sediment assemblages of two unenriched reservoirs. These sites presented low total phosphorus (15-18.9 µg L^{-1}), slightly acidic (pH 6.2-6.3) and electrolyte-poor waters (14 µS cm^{-1}).

Eunotia yanomami Metzeltin & Lange-Bertalot 1998: 86-87.
[Plate 79: LM: Figs 1-6, Plate 81: LM: Fig. 1, Plate 82: SEM: Fig. 2]

Bicca & Torgan (2009) separate *E. yanomami* from *E. zygodon* Ehrenberg by the presence of a trilobate nodule at the apices in the latter taxon, characteristic observed in illustrations from Patrick & Reimer (1966, pl. 11, fig. 8). Considering that feature is not easily viasualized, we distinguished them by the valve outline with higher and narrower dorsal undulations in the São Paulo population as presented in illustrations of the Brazilian type material (pl. 34, figs 1-6, Metzeltin & Lange-Bertalot 1998).
The longer specimen (150.8 µm, pl. 81, fig.1) presents flat undulations on the dorsal margin but is in accordance to the type material from Guyana that also presents large specimens (pl. 36, figs 5-6, Metzeltin & Lange-Bertalot 1998). This feature is present in other species like *E. anamargaritae* Metzeltin & Lange-Bertalot, but its apices are rounded and not cuneate as in *E. yanomami*.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	55.6-83.1(150.8)	(10.6)12-16.7	11-13(14)
Metzeltin & Lange-Bertalot (1998)	40-180	(10)12-18	-

Examined material selected: Ponte Nova (SP427983), Guarapiranga (SP469469).

Ecological aspects: Described from Guyana, the taxon was recently cited for Brazil and North America (Bicca & Torgan 2009, Siver & Hamilton 2011, Garcia *et al*. 2015). Siver & Hamilton (2011) found the species in acidic (pH 4.6), poorly buffered, humic-stained and oligotrophic waters (10.4 µg L^{-1}). In our dataset, it was rare and occurred in low abundances (< 1%) in planktonic and periphyton assemblages of two reservoirs (2% of all sites). These sites had slightly acidic to alkaline (pH 6.5-7.3), electrolyte-poor (14-48 µS cm^{-1}) and oligo- to mesotrophic (total phosphorus 9.3-37.5 µg L^{-1}) waters.

Eunotia yberai Frenguelli 1933: 446.
[Plate 90: LM: Figs 1-10, Plate 91: SEM: Figs 1-3]

The populations found agreed with the concept of the taxon in Metzeltin *et al.* (2005). *Eunotia yberai* presents similarities with *E. indica* Grunow, but differs by the apices. The latter taxon possess apices more rounded than cuneate as in our species.
Oliveira & Steinitz-Kannan (1992) illustrated a specimen very similar to the São Paulo population of *E. xystriformis*, but wrongly cited as *E. yberai*.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	24.4-73.4	7.8-11.7	9-14
Metzeltin *et al*. (2005)	34-100	9.3-13.3	7-10

Examined material selected: Barra Bonita (SP469545), Hedberg (SP469240), Salto Grande (SP469384).

Ecological aspects: Species cited from Uruguay and Brazil (*e.g.* Oliveira *et al*. 2001, Metzeltin *et al*. 2005, Bicca *et al*. 2011). It occurred in abundances lower than 1% in three enriched reservoirs (5% of all sites) with very high total phosphorus concentrations (85.3-590.7 µg L^{-1}), high conductivity (136-382 µS cm^{-1}) and alkaline (pH 7.6-9.6) waters. Oliveira *et al*. (2001) also reported this species in alkaline conditions (pH 7.3). In our dataset, *Eunotia yberai* was exclusively found in enriched waters (eutrophic to hypereutrophic reservoirs) and is probably a eutrophic species, however the ecological preferences could not be assessed due to the low frequency of the taxon.

Eunotia zygodon* var. *zygodon Ehrenberg 1843: 415 (127).
[Plate 80: LM: Figs 1-9, Plate 82: SEM: Fig. 1, Plate 83: SEM: Figs 1-3, Plate 84: SEM: Figs 1-3]

Reichardt (1995: 18) lectotypified Ehrenberg's taxon presenting one specimen very similar to the population found in São Paulo. Our specimens presented a large range of striae density encompassing the narrower range provided by Reichardt. Many varieties of *E. zygodon* exist in the literature, however more studies are necessary to separate the typical variety from other similar taxa. One of these similar taxa is *Eunotia tropica* Hustedt from Madagascar (Metzeltin & Lange-Bertalot 2002) that differs from *E. zygodon* by the less pronunciated undulations and less cuneate apices.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	64.4-119.7	11.3-15.7	10-17
Reichardt (1995)	53.3	10	10-11

Examined material selected: Guarapiranga (SP469469, SP428507, SP428508).

Ecological aspects: The taxon was mainly reported from South and North America (*e.g*. Patrick 1940, Patrick & Reimer 1966, Oliveira & Steinitz-Kannan 1992, Ferrari *et al*. 2007, Tremarin *et al.* 2008, Pearce *et al.* 2013). In our dataset, it was found in abundances lower than 0.5% in planktonic and surface sediment assemblages from mesotrophic sampling sites with slightly acidic to alkaline pH (6.6-7.3), low conductivity (42-50 µS cm^{-1}) and total phosphorus content of 25.1-37.5 µg L^{-1}.

Eunotia zygodon* var. *gracilis Hustedt in Schmidt *et al.* 1913: pl. 287, fig. 10.
[Plate 81: LM: Figs 3-5]

The narrower valves differentiate this taxon from the typical variety. Specimens found are rare and in accordance to the type material of Hustedt (Schmidt *et al*. 1913, Simonsen 1987).

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	32.2-50.1	6.5-8.4	13-16
Simonsen (1987) - measurements from the illustration provided by the author	75	8	15

Examined material selected: Ponte Nova (SP427983, SP468846).

Ecological aspects: Already reported from China (Qi & Li 2004), it is presently cited for the first time in Brazil. The variety was extremely rare and only two specimens were found in periphytic assemblage of an oligotrophic reservoir that presented low total phosphorus (9.3 µg L^{-1}), slightly acidic (pH 6.5) and electrolyte-poor waters (14 µS cm^{-1}).

Eunotia sp. 1

[Plate 17: LM: Figs 11-13]

The higher striae density of this taxon is the main feature that distinguishes it from the other close species. Thus, *E. intermedia* (Krasske) Nörpel-Schempp & Lange-Bertalot, presents lower striae density besides greater width (14-19/10 µm, 3.5-5.5 µm wide, Lange-Bertalot *et al*. 2011). *Eunotia disjuncta* Metzeltin & Lange-Bertalot presents also lower striae density (16-18/10 µm, Metzeltin & Lange-Bertalot 2007) and apices reflexed to the dorsal margin. Furthermore, *E. rhomboidea* also resembles the taxon but presents some heteropolar valves, coarse and lower striae density (see *E. rhomboidea*).

The low number of specimens found did not allow the observation of key characteristics for the taxon identification.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	14-25.8	2.6-3.1	24

Examined material selected: Billlings (SP427902), Tatu (SP469311, SP469289).

Ecological aspects: The species occurred in low abundances (≤ 1%) in phytoplankton and periphyton assemblages of two reservoirs (3.5% of all sites) that presented acidic to slightly acidic (pH 5.1-6.9), electrolyte-poor waters (32-63 µS cm^{-1}) and low total phosphorus (< 22.6 µg L^{-1}).

Eunotia sp. 2

[Plate 18: LM: Figs 5-6]

The species is very similar to our population of *E. fallacoides*, differing by the apices even more reflexed to the dorsal margin besides the ventral margin slightly concave and vaguely undulate

in the latter taxon. It also resembles *E. fallax* that presents more similar apices than *E. fallacoides* but ventral margin straight and narrower valves (2-2.3 µm, Lange-Bertalot *et al*. 2011) than *Eunotia* sp. 2. Furthermore, *E. neofallax* presents lower striae density (9-14/10 µm, Lange-Bertalot *et al*. 1996).
The low number of specimens found did not allow the observation of key characteristics for the taxon identification.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	28.9-30.5	3.1-3.7	16-17

Examined material selected: Cachoeira do França (SP469496).

Ecological aspects: This species presented one of the lowest frequency (2% of all sites) in our dataset, occurring in low abundance (< 1%) in periphytic assemblage from an ultraoligotrophic site. The limnological features were low conductivity (25 µS cm^{-1}), slightly alkaline (pH 7.5) and low total phosphorus (< 4 µg L^{-1}).

Eunotia sp. 3
[Plate 25: LM: Figs 18-24]

Presenting wide valves and attenuate to slightly protracted apices in larger specimens, *Eunotia* sp. 3 is similar to *E. pirla* J.R. Carter & Flower. However, this species presents ventral margin slightly triundulate and higher striae density (17/10 µm, Carter & Flower 1988) than found in our populations. Cavalcante *et al*. (2014) cited *E. pirla* for southern Brazil and expanded the range of striae density in relation to the type material (13-17/10 µm), but rounded-attenuate apices were observed on the entire population.
In the São Paulo populations, *Eunotia sudetica* differs from this species by the more radiate and denser striae (see *E. sudetica*). Nevertheless, compared to other populations of *E. sudetica* from Europe (pl. 48, Lange-Bertalot *et al*. 2011), the mainly difference between these taxa is the terminal nodules more distant from the apices and the dorsal margin straight to vaguely undulated in larger specimens of the latter.
It is probably a new species but more studies are necessary about the similarity with other taxa.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	25-40.1	6.3-7.9	11-12

Examined material selected: Cachoeira da Graça (SP427584).

Ecological aspects: One of the taxa with the lowest frequency (2% of all sites) and reported in low abundance (1.2%) in surface sediment assemblages of an oligotrophic reservoir. This site presented poor nutrient availability (total nitrogen 219.5 µg L^{-1} and total phosphorus 8.9 µg L^{-1}), acidic (pH 6.2) and low conductivity waters (16 µS cm^{-1}).

Eunotia sp. 4
[Plate 27: LM: Figs 8-13]

Eunotia sp. 4 is similar to the population presented by Hofmann *et al*. (2011) as *E. soleirolii* (Kützing) Rabenhorst, that however presents lower striae density (7-12/10 µm) and slight undulation on the ventral margin in large specimens. *Eunotia intermedia* (Krasske) Nörpel-Schempp & Lange-Bertalot differs by the presence of obtusely rounded apices and a vaguely undulation on the ventral margin of the medium-sized specimens, while *Eunotia* sp. 4 presents acutely rounded apices and consistently concave ventral margins.
It is probably a new species but more studies are necessary about the similarity with other taxa.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	18.2-48.8	4.5-5.5	14-17

Examined material selected: Billings (SP427902, SP401589).

Ecological aspects: The species occurred in acidic (pH 5.1-5.2) and low conductivity (34 µS cm^{-1}) waters of a mesotrophic site. The relative abundance was higher in surface sediment assemblages (3%).

Eunotia sp. 5
[Plate 27: LM: Figs 17-27]

The acutely protracted apices rarely reflexed to the dorsal margin characterize the taxon. *E. gracillimoides* Metzeltin & Lange-Bertalot presents similar morphometry but it always presents dorsally reflexed apices and slightly narrower valves (14-36 µm long, 3.5-4.7 µm wide, 15-17 striae in 10 µm, Metzeltin & Lange-Bertalot 2007). Furthermore, the terminal nodules are more visible and larger in *Eunotia* sp. 5.

Tremarin *et al*. (2008) illustrated a specimen (p. 851, fig. 17) as *E. fallax* similar to the larger specimens of *Eunotia* sp. 5 but the population is not correspondent, considering that *Eunotia fallax* always presents reflexed apices to the dorsal margin and terminal nodules closer to the apices.

It is probably a new species but more studies are necessary about the similarity with other taxa.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	13.1-29.2	2.8-3.9	14-18

Examined material selected: Jaguari (SP428857), Paiva Castro (SP469303), Pedro Beicht (SP427594), Ribeirão do Campo (SP427919, SP427916, SP468841, SP427921, SP427928, SP468843), Salto do Iporanga (SP469207).

Ecological aspects: This taxon was found in nine reservoirs from the State of São Paulo (17.5% of all sites), occurring from ultraoligo- to mesotrophic (total phosphorus < 39 µg L^{-1}), acidic to alkaline (pH 5.4-7.9) and low to median conductivity waters (10-155 µS cm^{-1}). Despite this wide distribution, higher abundance (maximum of 10.5%) occurred in ultraoligotrophic and acidic condition.

Eunotia sp. 6

[Plate 32: LM: Figs 15-18]

Eunotia fabeola Metzeltin & Lange-Bertalot resembles *Eunotia* sp. 6 by the valve outline with strongly convex dorsal margin and indistinctly protracted apices, but differs by the higher striae density (17-20/10 µm) and slightly wider valves (4.2-5.6 µm, Metzeltin & Lange-Bertalot 2007).

In the São Paulo populations, the species can be confused with *Eunotia* sp. 7, distinguishing by the higher striae density (15-20/10 µm) and slightly narrower valves (3.3-4/10 µm), besides the apices acutely rounded in the latter taxon.

More studies are required on the morphological variability of this taxon considering it may represent small specimens of another taxon.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	10.4-17.2	3.7-4.6	14-16

Examined material selected: Billings (SP427900, SP401586, SP427909, SP401589, SP427903), Guarapiranga (SP469474), Ribeirão do Campo (SP427919, SP468841, SP427921, SP468843).

Ecological aspects: In our study, the species was found in 12% of all sites, occurring from ultraoligotrophic to supereutrophic (total phosphorus < 166 µg L^{-1}), acidic to alkaline (pH 5.2-8.8) and low to high conductivity waters (10-277 µS cm^{-1}). Despite this wide distribution, higher abundance (maximum of 9.7%) occurred in ultraoligotrophic and acidic condition.

Eunotia sp. 7
[Plate 32: LM: Figs 19-23]

Close to *E. intermedia* (Krasske) Nörpel-Schempp & Lange-Bertalot, however the population found included only small specimens with slightly more acutely rounded apices. It also resembles *E. subarcuatoides* (pl. 17, figs 14-30), which presented narrower valves (2.5-3.3 µm) and higher striae density (18-25/10 µm) than *Eunotia* sp. 7.
More studies are required on the morphological variability of this taxon, considering it may represent small specimens of some taxon.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	12.4-16.5	3.3-4	15-20

Examined material selected: Jundiaí (SP427989, SP427988), Paraitinga (SP427984), Tatu (SP469376), Taiaçupeba (SP468833, SP427987, SP427986, SP468857).

Ecological aspects: In our study, it occurred in 7% of all sites, mainly in periphytic assemblages, in high abundance (maximum of 8%). This site presented poor phosphorus availability (total phosphorus 19-35 µg L^{-1}), slightly acidic (pH 6.2-6.9) and low conductivity waters (< 70 µS cm^{-1}).

Eunotia sp. 8

[Plate 49: LM: Figs 16-24, Plate 50: SEM: Figs 1-3]

The type material of *E. loboi* C.E.Wetzel & Ector (pl. 49, figs 25-33) was analysed to compare with the populations from São Paulo. Our specimens have similar morphometry but present lower striae density (*E. loboi*, 18-20/10 µm). In scanning electron microscopy other different characteristics were observed such as the presence of rimoportula and helictoglossae less developed in *Eunotia* sp. 8 (pl. 50, fig. 3), contrasting with the type material studied (pl. 50, fig. 5).

Other close species described in Wetzel *et al*. (2010) presented slender valves, E. *gomesii* (1.5-2.6 µm wide) and *E. waimiriorum* (1.8-2.2 wide), as well as different apices, respectively rectangular and rounded capitated shape.

It is probably a new species but more studies are necessary about this taxon.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	23.6-40.9	2.7-3.5	13-18

Examined material selected: Cachoeira da Fumaça (SP469200), Cachoeira do França (SP469496, SP469450), Guarapiranga (SP428507), Jundiaí (SP427988), Taiaçupeba (SP468835, SP427987, SP427986, SP468857).

Ecological aspects: The species had low frequency (9% of all sites) and occurred in all assemblages with maximum abundance of 5.3%. It was found in slightly acidic to alkaline pH (6.3-8.3), low conductivity (< 50 µS cm^{-1}) and ultraoligo to mesotrophic waters (total phosphorus < 35.1 µg L^{-1}).

Eunotia sp. 9

[Plate 55: LM: Figs 8-11]

This taxon is similar to *E. microcephala* Krasske that differs by presenting undulated margins.

For the southern region of Brazil, Tremarin *et al*. (2008) cited a population as *E. nymanniana* Grunow similar to this population found in São Paulo. However, *E. nymanniana* presents broadly rounded apices, larger and strongly arched valves, whereas *Eunotia* sp. 9 presents apices capitate and slightly arched to linear valves.

In addition, *E. groenlandica* (Grunow) Nörpel-Schempp & Lange-Bertalot in Pavlov & Levkov (2013, pl. 66, figs 32-50) is also very close to *Eunotia* sp. 9, however the lectotype materials (in Lange-Bertalot *et al*. 2011) possess protracted to subcapitate and dorsally reflexed apices, besides lower striae density (12-16/10 µm).

The low number of specimens found did not allow the observation of key characteristics for the taxon identification.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	11.6-19.7	2.3-2.6	16-19

Examined material selected: Ribeirão do Campo (SP468843), Cabuçu (SP428921).

Ecological aspects: The species was extremely rare and represented by two specimens found in the surface sediment assemblages of an unenriched and slightly enriched reservoirs. These sites presented acidic to slightly alkaline (5.4-7.4), electrolyte-poor waters (10-38 µS cm^{-1}) and total phosphorus < 15 µg L^{-1}.

Eunotia sp. 10

[Plate 64: LM: Figs 3-4]

Eunotia sp. 10 resembles two other species illustrated here, *E. superbidens* by the truncated dorsally reflexed apices and *E. bidens* by the measurements, but *Eunotia* sp. 10 presents more pronounced undulations in the dorsal margin. The population of *E. bidens* from Uruguay (Metzeltin *et al*. 2005) presents undulations more similar to our materials, however we chose to separate *Eunotia* sp. 10 by the difference present between our populations. *Eunotia sarek* A.Berg is part of the biggibous group of species with truncated apices but differs mainly by its broader valves (14-17 µm, Berg 1939).

The low number of specimens found did not allow the observation of key characteristics for the taxon identification.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	42.1-45.1	10.1-12.7	10-11

Examined material selected: Hedberg (SP469511), Taiaçupeba (SP468858).

Ecological aspects: Only two specimens were found in the surface sediment and planktonic assemblages of two reservoirs (3.5% of all sites). It was found in slightly acidic to alkaline pH (6.3-8.6), low to median conductivity (7-156 µS cm^{-1}) and mesotrophic to eutrophic waters (total phosphorus 21.7-85.7 µg L^{-1}).

Eunotia sp. 11
[Plate 101: LM: Figs 1-4, Plate 102: SEM: Figs 1-4]

Eunotia sp. 11 resembles *E. pseudoglacialis* Manguin by the longer valves with broadly rounded apices, but it can be distinguished by the narrower valves of Manguin's taxon (8-9 µm, Manguin 1964). Besides the studied population presents a slightly inflated median region of the valve. The variety of this taxon, *E. pseudoglacialis* var. *inflexa* mainly differs by the strongly arched valve. Furthermore, *E. major* var. *gigantea* Frenguelli in Metzeltin *et al*. (2005) is also very similar in valve outline, however the apices are capitated whereas *Eunotia* sp. 11 presents broadly rounded apices.
It is probably a new species but more studies are necessary mainly about the apices variability of *E. major* var. *gigantea*.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	100.6-152.4	9.2-10.3	10-12

Examined material selected: Hedberg (SP469534, SP469240).

Ecological aspects: The species was recorded in low abundance (< 1.5%) and frequency (2% of all sites) from a eutrophic reservoir that presented slightly acidic to alkaline waters (6.6-7.6), conductivity values of 117-136.5 µg L^{-1} and high phosphorus availability (total phosphorus 79.4-82.5 µg L^{-1}).

Eunotia sp. 12

[Plate 107: LM: Figs 1-3]

This taxon resembles *E. lineolata* Hustedt and agrees with other Brazilian population of this species (Laudares-Silva 1987), however the type material is not clearly known. *Eunotia curtiraphe* Metzeltin & Lange-Bertalot also presents a similar valve outline, but the terminal nodules are not visible contrasting to our population. In addition, *E. dacostae* Metzeltin & Lange-Bertalot differs by the attenuate apices, being broadly rounded in the São Paulo population. Tremarin *et al*. (2008) presented a Brazilian specimen of *E. dacostae* more similar (fig. 11) to our specimens, which also presented different apices compared to the type material. Due to its rarity in the study area and the lack of knowledge about the type of *E. lineolata* the taxon could not be identified at species level, requiring more studies.

	Length (µm)	**Width (µm)**	**Striae density (in 10 µm)**
This study	103.7-112.9	7.6-9.3	12-17

Examined material selected: Billings (SP427902), Guarapiranga (SP428507).

Ecological aspects: This taxon was rare and found in two oligo to mesotrophic reservoirs (3.5% of all sites) with relative abundances lower than 0.5%. These sites presented acidic waters (pH 5.1-6.6), low conductivity (31.7-41.8 µS cm^{-1}), low concentrations of total phosphorus (< 4-25 µg L^{-1}) and total nitrogen (610-692.6 µg L^{-1}).

Description of 12 unnamed *Eunotia* spp.

Eunotia sp. nov. 1

[Plate 19: LM: Figs 1-22, Plate 20: SEM: Figs 1-6, Plate 21: SEM: Figs 1-5]

This species presents a distinct valve outline presenting a 'fragilariod' shape. Other two *Eunotia* species presents a compared morphology: *E. pseudofragilaria* P.A.Siver, P.B.Hamilton & E.Morales and *E. croatana* P.A.Siver, P.B.Hamilton & E.Morales. The first taxon presents differentiated apices always capitated, but also differs by the lower striae density (29-31/10 µm in Siver *et al*. 2006) than *Eunotia* sp. nov. 1. *E. croatana* is more distinct with its linear valves, sigmoid in girdle view.

	Length (µm)	Width (µm)	Striae density (in 10 µm)
This study	26.7-61.1	1.8-3	30-34

Examined material selected: Pedro Beicht (SP427587, SP427594, SP427588, SP427595, SP427581, SP427582), Ribeirão do Campo (SP427916, SP427921, SP427928, SP468843).

Ecological aspects: Predominantly found in phytoplankton (12% of all sites), the species occurred from ultraoligotrophic to hypereutrophic conditions (total phosphorus < 271.4 µg L^{-1}), although in higher abundances (> 4%) in mesotrophic waters. Furthermore, it occurred in acidic waters (pH 5.4-6.9) with low conductivity (10-105 µS cm^{-1}).

Eunotia sp. nov. 2

[Plate 34: LM: Figs 1-7, Plate 35: LM: Figs 1-10, Plate 36: SEM: Figs 1-7]

Description: Light microscopy: Dorsiventral valves, ventral margin straight to slightly concave, dorsal margin almost straight to convex. Valve ends protracted rounded to subcapitate. Terminal raphe nodules very conspicuous at the apices. Terminal raphe fissures short, curving to the valve face. Striae parallel and equidistant, becoming radiant toward the apices. Areolae inconspicuous. No spines. Valves 19.9-63 µm long, 4.5-11.9 µm wide in the middle, with 12-17 striae in 10 µm. Scanning electron microscopy: External valve face wavy by the striae. Valve mantle perpendicular to the valve face with rounded juncture and continuous striae on the dorsal margin. Valve face with unisseriate striae, radiating toward the apices; interrupted on the ventral margin by a hyaline line. Areolae openings simple and rounded. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with short distal raphe endings turned towards the valve face; distal raphe endings with an expansion dropped-shaped. Internal valve face with a well-developed helictoglossae at each apices. Striae in channels. One rimoportulae below the helictoglossae. Girdle view with three copulae. Areolae 24-32 in 10 µm.

Taxonomic comments: The new taxon is characteristic by its set of features such as valve outline, striation pattern and position of the terminal raphe nodules. *Eunotia* sp. nov. 3 is very close related to this taxon, being separated by slightly differences on the valve outline in optic microscopy and by ultrastructural characters visible just in scanning electron microscopy.

These features are the ventral margin vaguely triundulate, the terminal raphe endings forming a hook and internally punctuated striae in *Eunotia* sp. nov. 3.

Eunotia inspectabilis Metzeltin & Lange-Bertalot (1998: pl. 34, figs 8-14) can be comparable to this new taxon because of the same valve outline but it presents rounded apices undifferentiated from the main valve body and terminal raphe nodules very conspicuous but not exactly in the apices as in *Eunotia* sp. nov. 2.

Examined material selected: Jundiaí (SP427988), Paiva Castro (SP469379, SP469259), Paraitinga (SP427984), Ponte Nova (SP427983), Tatu (SP469311, SP469376), Taiaçupeba (SP427986).

Ecological aspects: The species mainly occurred in periphytic assemblages in 10.5% of all sites with low abundance (maximum of 3.5%). Its ecological preference occurred in slightly acidic (pH optimum of 6.5), low conductivity (optimum of 29 µS cm^{-1}) and unenriched waters (total phosphorus optimum of 16.6 µg L^{-1} and total nitrogen optimum of 483.8 µg L^{-1}).

Eunotia sp. nov. 3

[Plate 35: LM: Figs 11-16, Plate 37: SEM: Figs 1-6]

Description: Light microscopy: Dorsiventral valves, ventral margin straight to vaguely triundulate, dorsal margin convex. Valve ends protracted rounded. Terminal raphe nodules conspicuous at the apices. Terminal raphe fissures curving in valve face toward the middle of the valve. Striae parallel and equidistant, becoming slightly radiant toward the apices. Areolae inconspicuous. No spines. Valves 14.4-42 µm long, 4.9-7.4 µm wide in the middle, with 11-14 striae in 10 µm. Scanning electron microscopy: External valve face wavy by the striae. Valve mantle perpendicular to the valve face with their juncture rounded and striae continuous on the dorsal margin. Valve face striae unisseriate and radiating toward the apices; interrupted on the ventral margin by a hyaline line. Areolae openings simple and rounded; can be occluded by a silica layer. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with distal raphe endings turned towards the valve face forming a hook; distal raphe endings with an expansion dropped-shaped. Internal valve face with a well-developed helictoglossae at each apices. Striae punctuated. One rimoportulae below the helictoglossae. Girdle view with three copulae. Areolae 30-32 in 10 µm.

Taxonomic comments: Similar to *Eunotia* sp. nov. 2 by the metric features and the terminal raphe nodules conspicuous at the apices, the latter taxon differs by its ventral and dorsal margin almost straight, the terminal raphe fissures short and the striation forming internal channels.

Examined material selected: Barra Bonita (SP469545, SP469557), Hedberg (SP469539, SP469534, SP469240), Salto Grande (SP469381, SP469372, 469375).

Ecological aspects: The species occurred in 9% of all sites with high relative abundance (maximum of 14%). It was better distributed in periphytic assemblages with ecological preference for high conductivity (optimum value of 172 μS cm^{-1}), slightly alkaline (optimum value of 7.7) waters and high nutrient condition (total phosphorus optimum of 66.5 μg L^{-1}, total nitrogen optimum of 1416.3 μg L^{-1}). According to our dataset, it is probably a eutrophic species.

Eunotia sp. nov. 4

[Plate 39: LM: Figs 1-12, Plate 40: SEM: Figs 1-5]

Description: Light microscopy: Dorsiventral valves, ventral margin slightly concave, dorsal margin convex. Valve ends broadly rounded to protracted cuneate. Terminal raphe nodules conspicuous at the apices. Terminal raphe fissures short, curving to the valve face. Striae parallel becoming slightly radiant toward the apices, short striae in the dorsal margin. Areolae inconspicuous. No spines. Valves 26-62.7 μm long, 7.2-8.7 μm wide in the middle, with 8-12 striae in 10 μm. Scanning electron microscopy: External valve face flat. Valve mantle perpendicular to the valve face with their juncture rounded and striae continuous on the dorsal margin. Valve face striae unisseriate and radiating slightly toward the apices; interrupted on the ventral margin by a hyaline line. Short striae on the dorsal margin comming from the valve mantle. Areolae openings simple and rounded; can be occluded by a silica layer. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with short distal raphe endings turned towards the valve face. Internal valve face with a well-developed helictoglossae at each apices. Striae punctuated. One well-developed rimoportulae in the middle of the apex. Areolae 32-40 in 10 μm.

Taxonomic comments: This new species presents a set of features very characteristic and distinct from other taxa. *Eunotia pomeranica* Lange-Bertalot, Bąk & Witkowski is comparable by its terminal raphe nodules and similar measurements (24-75 μm long, 6-9 μm wide, Lange-Bertalot *et al*. 2011). It is distinguished by the apices bluntly rounded in longer specimens whereas *Eunotia* sp. nov. 4 presents protracted cuneate apices. The striae density is also different, higher in *E. pomeranica* (11-15/10 µm).

Examined material selected: Guarapiranga (SP469474, SP469475, SP428513), Santa Helena (SP469524).

Ecological aspects: This species was found in 5% of all sites and had its highest relative abundance (6.7%) in a eutrophic reservoir (total phosphorus 66 µg L^{-1}). It occurred in neutral to alkaline (pH 7-8.9) and medium conductivity waters (105-156 µS cm^{-1}) with low to high nutrients availability (total phosphorus 12.8-165.4 µg L^{-1}, total nitrogen 435.1-3213 µg L^{-1}).

Eunotia sp. nov. 5

[Plate 41: LM: Figs 29-39, Plate 44: SEM: Figs 1-4]

Description: Light microscopy: Dorsiventral valves, ventral margin straight to slightly concave, dorsal margin convex. Valve ends protracted. Terminal raphe nodules conspicuous close to the apices. Terminal raphe fissures not visible. Striae parallel and equidistant, becoming slightly radiant toward the apices. Areolae inconspicuous. No spines. Valves 15-19.8 µm long, 2.6-3.3 µm wide in the middle, with 17-19 striae in 10 µm. Scanning electron microscopy: External valve face flat. Valve mantle perpendicular to the valve face with their juncture rounded and striae continuous on the dorsal margin. Valve face striae unisseriate and radiating slightly toward the apices; interrupted on the ventral margin by a hyaline line. Areolae openings simple and rounded. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with distal raphe endings almost restricted to the valve mantle; proximal raphe endings with an expansion dropped-shaped. Internal valve face with a well-developed helictoglossae at each apices. Striae punctuated or in channels. Rimoportulae absent. Areolae 40 in 10 µm.

Taxonomic comments: This new species presents valve outline similar to some taxa found in São Paulo samples such as *E. ibitipocaensis*, *E. intricans*, *E. incisa* and *E. incisatula*. In most cases, the larger valves of these species already differentiated from the small valves of *Eunotia* sp. nov. 5. In the smaller specimens, the separation can be made mainly by the higher number of striae in the new species. *Eunotia incisa* also presents high striae density but differs by its nose-like apices with terminal raphe nodules more distant from the poles.

Furthermore, the closest species, *E. siolii*, had its type material (pl. 41, figs 20-28) presently analysed and the separation of both taxa is clear. *Eunotia siolii* presents dorsal margin strongly convex, originating wider valves and also presents lower striae density (3.9-5.6 μm wide, 13-15 striae in 10 μm).

Examined material selected: Chapada Diamantina (SP391701).

Ecological aspects: This species was found in northeastern Brazil (Chapada Diamantina) in the epiliton. It occurred in waters with low conductivity (35-35 μS cm^{-1}), acidic pH (4) and low nutrients availability (total phosphorus 24.8-37.2 μg L^{-1} and total nitrogen 459.2-509.6 μg L^{-1}).

Eunotia sp. nov. 6

[Plate 47: LM: Figs 1-11, Plate 48: SEM: Figs 1-6]

Description: Light microscopy: Dorsiventral valves, almost linear, ventral margin slightly concave, dorsal margin slightly convex. Valve ends rounded. Terminal raphe nodules very conspicuous close to the apices. Terminal raphe fissures short, curving to the valve face. Striae parallel and equidistant. Areolae inconspicuous. No spines. Valves 33.1-42.2 μm long, 3.2-4.7 μm wide in the middle, with 15-18 striae in 10 μm. Scanning electron microscopy: External valve face wavy by the striae. Valve mantle perpendicular to the valve face with their juncture rounded and striae continuous on the dorsal margin. Valve face striae unisseriate, interrupted on the ventral margin by a hyaline line. Areolae openings simple and elliptic; can be occluded by a silica layer. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with short distal raphe endings turned towards the valve face. Internal valve face with a well-developed helictoglossae at each apices. Striae punctuated. One rimoportulae below the middle of the apex. Areolae 45-50 in 10 μm.

Taxonomic comments: The taxon presents valve outline very similar to *E. sennae* M.G.M.Souza & Compère, differing by all the metric features: longer and slightly narrower valves and higher striae density in the latter taxon (60-80 μm long, 2.5-4 μm wide, 20-26 striae in 10 μm, Souza & Compère 1999). Besides this, type specimens also possess terminal raphe nodules distant from the poles whereas our specimens present the nodules closer to the valve ends. Analysing other population, the Amazon specimens of *E. sennae* (p. 47, figs 12-14) presents wider valves and lower striae density than the type material and the new taxon, besides having longer valves (50.9-62.1 μm long, 5.3-6.2 μm wide, 13-15 striae in 10 μm).

Examined material selected: Billings (SP401589), Cabuçu (SP428942), Guarapiranga (SP428507, SP428508), Tatu (SP469311), Ribeirão do Campo (SP468843).

Ecological aspects: The species had low relative abundances (< 1%) and low frequency (10.5% of all sites). It was found in ultraoligo- to mesotrophic (total phosphorus < 25.4 μg L^{-1}), acidic to neutral (pH 5.2-7.0) and electrolyte-poor waters (10-50 μS cm^{-1}).

Eunotia sp. nov. 7
[Plate 55: LM: Figs 1-7, Plate 56: SEM: Figs 1-3]

Description: Light microscopy: Dorsiventral valves, ventral margin concave, dorsal margin straight. Valve ends protracted capitated, strongly reflexed to the dorsal margin. Small terminal raphe nodules conspicuous at the apices. Terminal raphe fissures not visible. Striae delicated, parallel and equidistant, becoming slightly radiant toward the apices. Areolae inconspicuous. No spines. Valves 16.5-20.7 μm long, 2.3-2.7 μm wide in the middle, with 23-24 striae in 10 μm. Scanning electron microscopy: External valve face wavy by the striae. Valve mantle perpendicular to the valve face with their juncture rounded and striae continuous. Valve face striae unisseriate and radiating slightly toward the apices. Areolae openings simple and rounded. Raphe-sternum narrow with a filiform raphe on the ventral valve mantle with short distal raphe endings turned towards the valve face; distal raphe endings with an expansion dropped-shaped. Internal valve face with a small helictoglossae at each apices. Striae punctuated. One small rimoportulae in the middle of the apex. Areolae 50 in 10 μm.

Taxonomic comments: The group of species related to this new species are numerous. Furey *et al*. (2011) recently described three new species among them. *Eunotia cataractarum* Furey, R.L. Lowe & J.R. Johansen and *E. orthodera* Furey, R.L. Lowe & J.R. Johansen present straight dorsal margin as *Eunotia* sp. nov. 7, however they differ by possessing wider valves and lower striae density. *Eunotia orthodera* also presents angular shoulders subtending the apices, whereas our specimens possess gentler shoulders. *Eunotia enischna* Furey, R.L. Lowe & J.R. Johansen can be distinguished by its convex dorsal margin as *E. exigua* (Brébisson) Rabenhorst, *E. tenella* (Grunow) Hustedt and *E. nymanniana* Grunow. The latter taxon differs likewise by the more arched valves and lower striae density, 17-21 in 10 μm (Lange-Bertalot *et al*. 2011).

Examined material selected: Billings (SP427902), Ribeirão do Campo (SP427919).

Ecological aspects: This species was rare and occurred in low abundances (< 1%) in two unenriched reservoirs (3.5% of all sites) with low availability of nutrients (total phosphorus < 4 µg L^{-1} and total nitrogen 367.6-610 µg L^{-1}), acidic (pH 5.1-5.6) and electrolyte-poor waters (32 µS cm^{-1}).

Eunotia sp. nov. 8

[Plate 58: LM: Figs 11-46, Plate 59: SEM: Figs 1-3, Plate 61: SEM:1-3]

Description: Light microscopy: Dorsiventral valves bacilliform, sometimes slightly heteropolar, ventral margin slightly concave, dorsal margin convex. Valve ends obtusely rounded, undifferentiated from the main body. Terminal raphe nodules conspicuous close to the apices. Terminal raphe fissures not visible. Striae parallel and equidistant, becoming radiant toward the apices. Areolae inconspicuous. No spines. Valves 9.2-17.6 µm long, 2-3.7 µm wide in the middle, with 15-20 striae in 10 µm. Scanning electron microscopy: External valve face flat. Valve mantle perpendicular to the valve face with their juncture rounded and continuous striae. Valve face striae unisseriate and radiating toward the apices; can be irregular on the dorsal valve margin with some shorter striae; ventral margins with irregularly spaced areolae near the juncture of valve face and mantle. Areolae openings simple and rounded. Raphe-sternum wide with a filiform raphe on the ventral valve mantle with distal raphe endings turned towards the valve face. Internal valve face with a small helictoglossae at each apices. Striae punctuated. One small rimoportulae almost or exactly at the center of apices. Heteropolar girdle with four copulae. Areolae 40-48 in 10 µm.

Taxonomic comments: Similar to *Eunotia botuliformis* Wild, Nörpel & Lange-Bertalot, *Eunotia* sp. nov. 8 presents narrower valves and lower striae density range, besides the rounded and more tapered apices. It is also close to *E. fallax* var. *aequalis* Hustedt (pl. 60, figs 3-4), but differentiates by the nose-like apices of the latter taxon, especially in larger specimens. In São Paulo, the closer species is *E. incisatula* Metzeltin & Lange-Bertalot that co-occurred with this new species. They differ in the apices format as in *E. fallax* var. *aequalis*.

The new species is widely distributed in tropical regions, besides southeast and northern regions of Brazil and has been often confused with other taxa. Populations of *Eunotia* sp. nov. 8 were illustrated for South Africa as *E. rhomboidea* Hustedt (Taylor *et al.* 2007). Although some valves may be slightly heteropolar, the species is quite distinct from *E. rhomboidea* that presents larger and more clearly heteropolar valves. However, in girdle view, both present rhomboid format, unusual characteristic in *Eunotia*. For southeast Brazil, one specimen was identified as

Eunotia intermedia (Krasske ex Hustedt) Nörpel & Lange-Bertalot in Tremarin *et al.* (2008, fig. 28), but this taxon presents obtusely rounded apices and wider valves. In the State of São Paulo, *Eunotia* sp. nov. 8 was already reported as *E. faba* Ehrenberg (Bicudo *et al.* 1999).

Examined material selected: Billings (SP401565), Cachoeira do França (SP469496, 469450), Guarapiranga (SP428507, SP469470, SP428508), Hedberg (SP469508), Ribeirão do Campo (SP427921, SP427928), Pedro Beicht (SP427581).

Ecological aspects: The species had the largest distribution in our dataset, occurring approximately in 68% of all sites. It was mainly found in surface sediment assemblages with ecological preference for low conductivity (optimum value of 30 µS cm^{-1}), slightly acidic waters (optimum value of 6.3) and low nutrients availability (total phosphorus optimum of 16 µg L^{-1} and total nitrogen optimum of 448.2 µg L^{-1}). Our results are in accordance with Taylor *et al*. (2007, as *E. rhomboidea*) from oligotrophic and electrolyte-poor waters.

Eunotia sp. nov. 9
[Plate 67: LM: Figs 8-9]

Description: Light microscopy: Dorsiventral valves, ventral margin with a concave undulation in the middle, dorsal margin triundulate. Valve ends protracted. Terminal raphe nodules conspicuous close to the apices. Terminal raphe fissures not visible. Striae radiant toward the apices. Areolae inconspicuous. No spines. Valves 29.9-33.1 µm long, 6.9-7.3 µm wide in the middle, with 11-12 striae in 10 µm. Scanning electron microscopy: not observed.

Taxonomic comments: The species is easily differentiated from all known taxa with dorsal triundulate margin. *E. tridentula*, *E. trigibba* and *E. tecta* present more dorsiventral valves with more pronounced central undulation on the dorsal margin, while *Eunotia* sp. nov. 9 possess three undulations of equal size.

Examined material selected: Ribeirão do Campo (SP468841).

Ecological aspects: The species was very rare presenting the lowest frequency (2% of all sites) in the study area. It occurred with low abundance (2.2%) in surface sediment assemblage of an ultraoligotrophic reservoir that presented poor nutrient availability (total phosphorus < 10 µg L^{-1} and total nitrogen < 400 µg L^{-1}), acidic (pH 5.6) and low conductivity waters (10 µS cm^{-1}).

Eunotia sp. nov. 10

[Plate 73: LM: Figs 1-17, Plate 74: LM: Figs 1-8, Plate 75: SEM: Figs 1-5, Plate 76: SEM: Figs 1-4]

Description: Light microscopy: Dorsiventral valves, ventral margin straight to concave, dorsal margin 4-2 undulate. Valve ends protracted, broadly rounded to capitated, dorsally reflexed. Small terminal raphe nodules conspicuous at the apices. Terminal raphe fissures not visible. Striae parallel and equidistant, becoming radiant toward the apices. Areolae inconspicuous. No spines. Valves 15.1-59 µm long, 5.1-8.1 µm wide (the grater width), with 10-15 striae in 10 µm. Scanning electron microscopy: External valve face wavy by the striae. Valve mantle perpendicular to the valve face with their juncture straight and striae continuous on the dorsal margin. Valve face striae unisseriate and radiating toward the apices; interrupted on the ventral margin by a hyaline line. Areolae openings simple and rounded; can be occluded by a silica layer. Raphe-sternum wide with a filiform raphe on the ventral valve mantle reaching the dorsal mantle curving across the valve face. Internal valve face with a helictoglossae at each apices. Striae punctuated. One rimoportulae above the middle of the apex. Girdle view with six copulae. Areolae 22-30 in 10 µm.

Taxonomic comments: This taxon is widely cited in literature as *E. camelus*, however both species can be easily distinguished by their characteristic dorsal and ventral margins, besides the wider valves of *E. camelus*. The latter taxon presents the dorsal margin with two undulations subdivided into two more and the ventral margin forms a concave arc apex to apex. In *Eunotia* sp. nov. 10, the dorsal margin presents four or two major undulations and the ventral margin is less concave with apices differentiate in some specimens.

Eunotia bicornigera Metzeltin & Lange-Bertalot is also found in the study area, even though it is extremely rare, having dorsal margin undulate as our new species. It presents different apices protracted with terminal raphe nodules distant from the valve ends and a swollen bellow them in the ventral margin, thereby differing from *Eunotia* sp. nov. 10. *Eunotia cameliopsis* Metzeltin & Lange-Bertalot (pl. 74, figs 10-15) differs by the wider valves (10-12 µm wide, Metzeltin & Lange-Bertalot 1998), apices obtusely protracted and the more pronounced undulations.

Examined material selected: Guarapiranga (SP469469, SP428508), Paiva Castro (SP469281, SP469379), Tatu (SP469311, SP469289, SP469385, SP469376, SP469267), Tanque Grande (SP428920).

Ecological aspects: The species was well distributed in the dataset, occurring in 31.5% of all sites and in high abundances (maximum of 11.2%). It was mainly found in periphyton assemblages with ecological preferences for medium conductivity (optimum value of 71 µS cm^{-1}), slightly acidic (optimum pH value of 6.6) and mesotrophic waters (total phosphorus optimum of 34.2 µg L^{-1} and total nitrogen optimum of 862.7 µg L^{-1}).

Eunotia sp. nov. 11
[Plate 77: LM: Figs 8-9]

Description: Light microscopy: Dorsiventral valves, ventral margin strongly concave, dorsal margin 7-8 undulate. Valve ends attenuate. Terminal raphe nodules conspicuous at the apices. Terminal raphe fissures curving to the valve face. Striae radiant toward the apices. Areolae inconspicuous. No spines. Valves 59.6-88.2 µm long, 16.2-19.4 µm wide (the greater width), with 7 striae in 10 µm. Scanning electron microscopy: Not observed.

Taxonomic comments: *Eunotia* sp. nov. 11 shares a common characteristic with several other *Eunotia* species: the quite undulating dorsal margin. Metzeltin & Lange-Bertalot (1998) presents a specimen without a name (pl. 42, fig. 6) very similar to *Eunotia* sp. nov. 11 from Guyana. *E. georgii* also occurred in São Paulo samples and it differs from the new taxon by the narrower valves and higher striae density, besides the usually less concave dorsal margin (except for deformed valves, pl. 77, figs 6-7) and sometimes the greater number of undulations. *Eunotia serra-australis* Metzeltin & Lange-Bertalot possess narrower valves and higher striae density (12-14 µm wide, 10-11 striae in 10 µm, Metzeltin & Lange-Bertalot 1998) as *E. georgii*. *E. diadema* Ehrenberg is the closest species, with similar metric features, but presents always six undulations more rounded and less pointed than in the São Paulo specimens. In addition, type material of *E. muelleri* Hustedt in Schmidt *et al.* (pl. 78, figs 1-3) presents valve ends broadly rounded differing from our population.

Examined material selected: Ribeirão do Campo (SP468841).

Ecological aspects: The species was very rare with relative abundance lower than 0.5%. It occurred once (2% of all sites) in surface sediment assemblage of an ultraoligotrophic reservoir with low nutrient availability (total phosphorus < 4 µg L^{-1} and total nitrogen 383.6 µg L^{-1}), acidic (pH 5.6) and electrolyte-poor waters (10 µS cm^{-1}).

Eunotia sp. nov. 12

[Plate 106: LM: Figs 1-5]

Description: Light microscopy: Dorsiventral valves, ventral margin strongly concave, dorsal margin strongly convex. Valve ends rounded. Terminal raphe nodules very conspicuous close to the apices. Terminal raphe fissures curving to the valve face. Striae parallel and equidistant, becoming radiant toward the apices. Areolae inconspicuous. No spines. Valves 86.9-133.7 µm long, 7.9-9.9 µm wide in the middle, with 12-16 striae in 10 µm. Scanning electron microscopy: Not observed.

Taxonomic comments: *Eunotia* sp. nov. 12 presents many morphometric similarities with *E. pseudopectinalis* Hustedt as the valve outline and measurements (88-168.7 µm long, 5.3-10 µm wide, 11-13 striae in 10 µm, Kulikovskiy *et al*. 2010). However, the terminal raphe nodules are distinct, being smaller at the end of valve in Hustedt's species and bigger and more distant from the apices in our specimens. In addition, *E. pseudopectinalis* presents terminal raphe fissures very evident curving to the valve center, feature not observed in the São Paulo population.
Eunotia soleri Metzeltin & Lange-Bertalot also presents similar valve outline and terminal raphe nodules in the same position, but differs by the wider valves and lower striae density (13-16 um wide, 10-12 striae in 10 µm, Metzeltin & Lange-Bertalot 1998).

Examined material selected: Ribeirão do Campo (SP468843).

Ecological aspects: The species was very rare and one specimen was found in the surface sediment of an ultraoligotrophic reservoir with acidic (pH 5.4), very low conductivity (10 µS cm^{-1}) waters and low nutrient availability (total phosphorus < 4 µg L^{-1} and total nitrogen 292.7 µg L^{-1}).

IV. References

Alles, E., Nörpel-Schempp, M. & Lange-Bertalot, H. 1991. Zur Systematik und Ökologie charakteristischer *Eunotia*-Arten (Bacillariophyceae) in elektrolytarmen Bachoberläufen. Nova Hedwigia 53 (1-2): 171-213.

Almeida, P.D. & Bicudo, D.C. 2014. Diatomáceas planctônicas e de sedimento superficial em represas de abastecimento da Região Metropolitana de São Paulo, SP, Sudeste do Brasil. Hoehnea 41: 182-207.

Almeida, P.D., Wetzel, C.E., Morales, E.A., Ector, L. & Bicudo, D.C. 2015. *Staurosirella acidophila* sp. nov., a New Araphid Diatom (Bacillariophyta) from Southeastern Brazil: Ultrastructure, Distribution and Autecology. Cryptogamie, Algologie 36 (3): 255-270.

Antoniades, D., Hamilton, P.B., Douglas, M.S.V. & Smol, J.P. 2008. Diatoms of North America. The Freshwater Floras of Prince Patrick, Ellef Ringnes, and Northern Ellesmere Islands from the Canadian Arctic Archipelago. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Diversity-Taxonomy-Geobotany. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 17: 649 p.

APHA 2005 Standard methods for the examination of water and wastewater, 21st Edition, American Public Health. Association, Washington DC, 1368 pp.

Aprile, F.M. & Mera, P.A.S. 2007. Fitoplâncton e fitoperifíton de um rio de águas pretas da Amazônia periférica do Norte, Brasil. Brazilian Journal of Aquatic Science and Technology 11 (2): 1-14.

Bartozek, E.C.R., Bueno, N.C., Ludwig, T.A.V., Tremarin, P.I., Nardeli, M.S. & Rocha, A.C.R. 2013. Diatoms (Bacillariophyceae) of Iguaçu National Park, Foz do Iguaçu, Brazil. Acta Botanica Brasilica 27 (2): 108-123.

Berg, Å. 1939. Some new species and forms of the genus *Eunotia* Ehr. 1837. Botaniska Notiser 1939: 423-462.

Bertolli, L.M., Tremarin, P.I. & Ludwig, T.A. 2010. Diatomáceas perifíticas em *Polygonum hydropiperoides* Michaux, reservatório do Passaúna, Região Metropolitana de Curitiba, Paraná, Brasil. Acta Botanica Brasilica 24 (4): 1065-1081.

Bicca, A.B. & Torgan, L.C. 2009. Novos registros de *Eunotia* Ehrenberg (Eunotiaceae-Bacillariophyta) para o Estado do Rio Grande do Sul e Brasil. Acta Botanica Brasilica 23 (2): 427-435.

Bicca, A.B., Torgan, L.C. & Santos, C.B. 2011. Eunotiaceae (Eunotiales, Bacillariophyta) em ambientes lacustres na Planície Costeira do Sul do Brasil. Revista Brasileira de Botânica 34: 1-19.

Bicudo, D.C., De-Lamonica-Freire, E., Figueiredo, D. M. & Lima, D. 1995. Ficoflórula do Pantanal de Poconé, Estado de Mato Grosso, Brasil: Centrales e Eunotiaceae (Bacillariophyceae). Hoehnea 22 (1/2): 165-182.

Bicudo, D.C., Morandi, L.L. & Ludwig, T.A.V. 1999. Criptógamos do Parque Estadual das Fontes do Ipiranga, São Paulo, SP. Algas, 13: Bacillariophyceae (Eunotiales). Hoehnea 26: 173-184.

Bourrelly, P. & Manguin, E. 1952. Algues d'eau douce de la Guadeloupe et dépendances recueillies par la Mission P. Allorge en 1936. Centre National de la Recherche Scientifique, Société d'Edition d'Enseignement Supérieur, Paris. 282 p.

Buczkó, K. & Magyari, E. 2007. The Holocene diatom flora of Lake Saint Anna (Eastern Carpathians, Europe). Algological Studies 124: 1-28.

Burliga, A.L. & Kociolek, J.P. 2012. Four new *Eunotia* Ehrenberg species (Bacillariophyceae) from pristine regions of Carajás National Forest, Amazonia, Brazil. Nova Hedwigia 141: 53-70.

Camburn, K.E. & Charles, D.F. 2000. Diatoms of low-alkalinity lakes in the northeastern United States. The Academy of Natural Sciences of Philadelphia, Special Publication 18: 1-152.

Campeau, S., Pienitz, R. & Héquette, A. 1999. Diatoms from the Beaufort Sea coast, southern Arctic Ocean (Canada). Modern analogues for reconstructing Late Quaternary environments and relative sea levels. Bibliotheca Diatomologica 42: 1-244.

Canani, L.G.C & Torgan, L.C. 2013. Two new *Eunotia* species with subapical costae, an uncommon structure for the genus. Diatom Research 28 (4): 395-406.

Canani, L.G.C., Menezes, M. & Torgan, L.C. 2011. Diatomáceas epilíticas de águas oligotróficas e ácidas do Sudeste do Brasil. Acta Botanica Brasilica 25: 130-140.

Cantonati, M & Lange-Bertalot, H. 2011. Diatom monitors of close-to-pristine, very-low alkalinity habitats: three new *Eunotia* species from springs in Nature Parks of the south-eastern Alps. Journal of Limnology 70 (2): 209-221.

Carter, J.R. & Flower, R.J. 1988. A new species of *Eunotia*, *E. pirla* sp. nov., from Woolmer Pond, an acid pool in the southeast of England. Diatom Research 3 (1): 1-8.

Cassie, V. 1989. A contribution to the study of New Zealand diatoms. Bibliotheca Diatomologica 17: 1-266.

Cavalcante, K.P., Tremarin, P.I., Castro, E.C., Tibiriçá, C.E.J.A., Wojciechowski, J. & Ludwig, T.A.V. 2014. Epiphytic *Eunotia* (Bacillariophyceae) on *Podostemum* from Santa Catarina, southern Brazil, including new observations on morphology and taxonomy of some rare recorded species. Biota Neotropica 14(3): 1-12.

CEPAGRI – Centro de Pesquisas Meteorológicas e Climáticas Aplicadas a Agricultura. 2015. A classificação climática de Koeppen para o Estado de São Paulo. – Available online at http://www.cpa.unicamp.br/outras-informacoes/clima-dos-municipios-paulistas.html; searched on September 24, 2015.

Cholnoky, B.J. 1955. Hydrobiologische Untersuchungen in Transvaal I. Vergleichung der herbstlichen Algengemeinschaften in Rayton-vlei und Leeufontein. Hohenackers Meeresalgen 7: 137-209.

Costa-Böddeker, S., Bennion, H., Jesus, T.A., Albuquerque, A.L.S., Figueira, R.C.L. & Bicudo, D.C. 2012. Paleolimnologically inferred eutrophication of a shallow tropical urban reservoir, Southeast Brazil. – J. Paleolimnol. 48 (4): 751–766.

Cumming, B.F., Laird, K.R., Gregory-Eaves, I., Simpson, K.G., Sokal, M.A., Nordin, R.N. & Walker, I.R. 2015. Tracking past changes in lake-water phosphorus with a 251-lake calibration dataset in British Columbia: tool development and application in a multiproxy assessment of eutrophication and recovery in Osoyoos Lake, a transboundary lake in Western North America. Front. Ecol. Evol. 3: 84.

Denys, L. 1991. A checklist of the diatoms in the Holocene deposits of the western Belgian coastal plain with a survey of their apparent ecological requirements, I: introduction, ecological code and complete list. Service Géologique de Belgique 246: 1-41.

De Toni, G.B. 1892. Sylloge algarum omnium hucusque cognitarum. Vol. II. Bacillarieae; sectio II. Pseudoraphideae. Typis Seminarrii, Patavii: 491-817.

Díaz-Castro, J.G., Souza-Mosimann, R.M., Laudares-Silva. R. & Forsberg, B.R. 2003. Composição da comunidade de diatomáceas perifíticas do Rio Jaú, Amazonas, Brazil. Acta Amazonica 33 (4): 583-606.

Edlund, M.B. & Brant, L.A. 2010. *Eunotia charliereimeri*, A New *Eunotia* Species (Bacillariophyceae) with Amphoroid Frustule Symmetry.

Ehrenberg, C.G. 1843. Verbreitung und Einflufs des mikroskopischen Lebens in Süd- und Nord-Amerika. Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin 1841: 291-446, 4 pls.

Ehrenberg, C.G. 1848. Die Mikroskopischen Lebenformen. In: R.H. Schomburgk (ed.) Versuch einer Fauna und Flora von Britisch-Guiana. Leipzig, J.J. Weber, Vol. 3: 537-544.

Ehrenberg, C.G. 1854. Mikrogeologie. Einundvierzig Tafeln mit über viertausend grossentheils colorirten Figuren, Gezeichnet vom Verfasser [Atlas]. Leopold Voss, Leipzig., 40 pls.

Fallu, M.A., Allaire, N. & Pienitz, R. 2000. Freshwater diatoms from northern Québec and Labrador (Canada). Species-environment relationships in lakes of boreal forest, forest-tundra and tundra regions. Bibliotheca Diatomologica 45: 1-200.

Faria, D.M., Tremarin, P.I. & Ludwig, T.A.V. 2010. Diatomáceas perifíticas da represa Itaqui, São José dos Pinhais, Paraná: Fragilariales, Eunotiales, Achnanthales e *Gomphonema* Ehrenberg. Biota Neotropica 10 (3): 415-427.

Ferrari, F., Procopiak, L.K., Alencar, Y.B. & Ludwig, T.A.V. 2007. Eunotiaceae (Bacillariophyceae) em igarapés da Amazônia Central, Manaus e Presidente Figueiredo, Brasil. Acta Amazonica 37: 1-16.

Foged, N. 1976. Freshwater diatoms in Sri Lanka (Ceylon). Bibliotheca Phycologica 23: 1-112.

Foged, N. 1977. Freshwater diatoms in Ireland. Bibliotheca Phycologica 34: 1-220.

Foged, N. 1978. Diatoms in Eastern Australia. Bibliotheca Phycologica 41: 1-148.

Foged, N. 1980. Diatoms in Öland Sweden. Bibliotheca Phycologica 49: 1-193.

Foged, N. 1984. Freshwater and Littoral Diatoms from Cuba. Bibliotheca Diatomologica 5: 1-243.

Foged, N. 1986. Diatoms in Gambia. Bibliotheca Diatomologica 12: 1-153.

Fontana, L. & Bicudo, D.C. 2012. Biodiversidade e distribuição das diatomáceas (Bacillariophyceae) de sedimentos superficiais nos reservatórios em cascata do rio Paranapanema, SP/PR, Brasil. Hoehnea 39 (4): 587-614.

Fontana, L., Albuquerque, A.L.S., Brenner, M., Bonotto, D.M., Sabaris, T.P.P., Pires, M.A.F., Cotrim, M.E.B. & Bicudo, D.C. 2014. The eutrophication history of a tropical wáter supply reservoir in Brazil. Journal of Paleolimnology 51: 29-43.

Frenguelli, J. 1933. Contribuciones al conocimiento de las diatomeas Argentinas. VII. Diatomeas de la región de los Esteros del Ybera (en la Provincia de Corrientes). Anales del Museo Nacional de Historia Natural 37: 365-475.

Frenguelli, J. 1941. Diatomeas del Río de la Plata. Revista del Museo de la Plata 3: 213-334.

Frenguelli, J. 1942. Contribución al conocimiento de las diatomeas del Neuquén (Patagonia). Revista del Museu de La Plata (Nueva serie) 5, Botânica 20: 73-219.

Fungladda, N. & Kaczmarska, I. 1983. A contribution to the freshwater diatom flora of the Hawaiian Islands. Bibliotheca Diatomologica 2: 1-103.

Furey, P.C., Lowe, R.L. & Johansen, J.R. 2011. *Eunotia* Ehrenberg (Bacillariophyta) of the Great Smoky Mountains National Park, USA. Bibliotheca Diatomologica 56: 1-133.

Fürstenberger, C.B. & Valente-Moreira, I.M. 2000. Diatomáceas (Bacillariophyta) perifíticas da lagoa Tarumã, Ponta Grossa, Paraná, Brasil. 2. Eunotiaceae. Insula 29: 117-134.

Garcia, D.R., Bueno, N.C., Nardelli, M.S., Tremarin, P.I., Ludwig, T.A.V. & Baumgartner, G. 2015. *Eunotia* Ehrenberg (Bacillariophyceae) in the Hercílio River, Santa Catarina, southern Brazil. Brazilian Journal of Botany 38 (3): 623-637.

Gregory, W. 1854. Notice of the new forms and varieties of known forms occurring in the diatomaceous earth of Mull; with remarks on the classification of the Diatomaceae. Quarterly Journal of Microscopical Science 2: 90-100.

Grunow, A. 1862. Die österreichischen Diatomaceen nebst Anschluss einiger neuen Arten von andern Lokalitäten und einer kritischen Uebersicht der bisher bekannten Gattungen und Arten. Erste Folge. Epithemieae, Meridioneae, Diatomeae, Entopyleae, Surirelleae, Amphipleureae. Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien 12: 315-472, 6 pls.

Grunow, A. 1867. Reise seiner Majestät Fregatte Novara um die Erde. Botanischer Theil. Band I. Algen. Wien, aus der Kaiselich-Königlichen Hof-und Staasdruckerei. 104 p.

Guzkowska, M.A.J. & Gasse, F. 1990. Diatoms as indicators of water quality in some English urban lakes. Freshwater Biology 23: 233-250.

Håkansson, S. 1993. Numerical methods for the inference of pH variations in mesotrophic and eutrophic lakes in Southern Sweden – a progress report. Diatom Research 8 (2): 349-370.

Hamilton, P.B. & Siver, P.A. 2010. A Morphological Investigation of *Eunotia fennica* (Bacillariophyceae) from a Freshwater Acidic Pond in Newfoundland, Canada. Proceedings of the Academy of Natural Sciences of Philadelphia 160: 89-98.

Hein, M.K. 1990. Flora of Adak Island, Alaska: Bacillariophyceae (Diatoms). Bibliotheca Diatomologica 21: 1-133.

Hofmann, G. 1994. Aufwuchs-Diatomeen in Seen und ihre Eignung als Indikatoren der Trophie. Bibliotheca Diatomologica 30: 1-241.

Hofmann, G., Werum, M. & Lange-Bertalot, H. 2011. Diatomeen im Süβwasser-Benthos von Mitteleuropa. Bestimmungsflora Kieselalgen für die ökologische Praxis. Über 700 der häufigsten Arten und ihre Ökologie. A.R.G. Gantner Verlag K.G., Ruggell, 908 p.

Hustedt, F. 1930. Bacillariophyta (Diatomeae). In: Pascher, A. (ed.), Die Süsswasser-Flora Mitteleuropas. Gustav Fischer, Jena. Zweite Auflage. Heft 10: 466 p.

Hustedt, F. 1949. Süsswasser-diatomeen aus dem Albert-Nationalpark in Belgisch-Kongo. In: Exploration of National Park Albert. Mission H. Damas (1935-1936). 199 p.

Hustedt, F. 1950. Die Diatomeenflora norddeutscher Seen mit besonderer Berücksichtigung des holsteinischen Seengebiets V-VII. Seen in Mecklenburg, Lauenburg und Nordostdeutschland. Archiv für Hydrobiologie 43: 329-458.

Hustedt, F. 1952. Neue und wenig bekannte Diatomeen. III. Phylogenetische Variationen bei den raphidioiden Diatomeen. Bericht der Deutschen Botanischen Gessellschaft 65 (5): 133-144.

Kim, Y.S., Choi, J.S. & Kim, H.S. 2007. Epiphytic diatom communities from two mountain bogs in South Korea. Nova Hedwigia 84 (3-4): 363-379.

Kobayasi, H., Ando, K. & Nagumo, T. 1981. On some endemic species of the genus *Eunotia* in Japan. In: R. Ross (ed.), Proceedings of the Sixth Symposium on Recent and Fossil Diatoms, Budapest, September 1-5, 1980, Taxonomy-Morphology-Ecology-Biology. Koeltz Publishing, Koenigstein, pp. 93-114.

Kociolek, J.P. 2000. Valve ultrastructure of some Eunotiaceae (Bacillariophyceae), with comments on the evolution of the raphe system. Proceedings of the California Academy of Sciences 52 (2): 11-21.

Krammer, K. & Lange-Bertalot, H. 1991. Bacillariophyceae 4. Teil: Achnanthaceae Kritische Ergänzungen zu s.l., *Navicula* s.str., *Gomphonema* Gesamtliteraturverzeichnis Teil 1-4. In: Ettl, H., Gärtner, G., Heynig, H. & Mollenhauer, D., Suesswasserflora von Mitteleuropa. VEB Gustav Fisher Verlag, Jena, Vol. 2/4: 437 p.

Krasske, G. 1939. Zur Kieselalgenflora Südchiles. Archiv für Hydrobiologie 35: 349-468.

Krasske, G. 1948. Diatomeen tropischer Moosrasen. Svensk Botanisk Tidskrift 42 (4): 404-443.

Krstic, S.S., Pavlov, A., Levkov, Z. & Jüttner, I. 2013. New *Eunotia* taxa in core samples from Lake Panch Pkhari in the Nepalese Himalaya. Diatom Research 28 (2): 203-217.

Kulikovskiy, M.S., Lange-Bertalot, H., Witkowski, A., Dorofeyuk, N.I. & Genkal, S.I. 2010. Diatom assemblages from *Sphagnum* bogs of the world. I. Nur bog in northern Mongolia. Bibliotheca Diatomologica 55: 1-326.

Kützing, F.T. 1844. Die kieselschaligen Bacillarien oder Diatomeen. Nordhausen. 152 p., 30 pls.

Lange-Bertalot, H. 1993. 85 neue Taxa und über 100 weitere neu definierte Taxa ergänzend zur Süsswasserflora von Mitteleuropa, Vol. 2/1-4. Bibliotheca Diatomologica 27: 1-454.

Lange-Bertalot, H. & Metzeltin, D. 1996. Indicators of Oligotrophy. 800 taxa representative of three ecologically distinct lake types. Carbonate buffered – Oligodystrophic – Weakly buffered soft water. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein. Vol. 2: 390 p.

Lange-Bertalot, H. & Metzeltin, D. 2009. A dystrophic mountain lake in Panama – hot spot of new and rare Neotropical diatoms. Nova Hedwigia 135: 137-166.

Lange-Bertalot, H., Külbs, K., Lauser, T., Nörpel-Schempp, M. & Willmann, M. 1996. Dokumentation und Revision der von Georg Krasske beschriebenen Diatomeen-Taxa. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein, Vol. 3: 358 p.

Lange-Bertalot, H., Bąk, M. & Witkowski, A. 2011. *Eunotia* and some related genera In: Lange-Bertalot, H. (ed.). Diatoms of Europe. A.R.G. Gantner Verlag K.G., Ruggell, distributed by Koeltz Scientific Books, Koenigstein. 747 p.

Laudares-Silva, R. 1987. Estudo taxonômico das diatomáceas (Bacillariophyceae) coletadas no Arroio do Faxinal (Sanga da Água Boa), Torres, Rio Grande do Sul, Brasil. Ínsula 17: 3-176.

Laux, M. & Torgan, L.C. 2011. Diatomáceas com plastídeos no plâncton da foz dos rios do Delta do Jacuí, sul do Brasil: um complemento à taxonomia tradicional. Iheringia, Série Botânica 66: 109-132.

Liu, Y., Wang, Q. & Fu, C. 2011. Taxonomy and distribution of diatoms in the genus *Eunotia* from the Da'erbin Lake and surrounding bogs in the Great Xing'an Mountains, China. Nova Hedwigia 92 (1-2): 205-232.

Lowe, R.L. 1974. Environmental Requirements and Pollution Tolerance of Freshwater Diatoms. National Environmental Research Center, Ohio.

Lyra, L.T. 1971. Algumas diatomáceas encontradas em Bromeliáceas, Brasil. Memórias do Instituto Oswaldo Cruz 69: 129-139.

Manguin, E. 1964. Contribution à la connaissance des diatomées des Andes du Pérou. Mémoires du Muséum National d'Histoire Naturelle 12 (2): 41-98.

Mann, D., Chepurnov, V.A. & Idei, M. 2003. Mating system, sexual reproduction, and auxosporulation in the anomalous raphid diatom *Eunotia* (Bacillariophyta). Journal of Phycology 39: 1067-1084.

Mayama, S. 1997. *Eunotia valida* and *E. pseudovalida* spec. nov. (Bacillariophyceae): Ultrastructure of the valve and girdle. Nova Hedwigia 65(1-4): 165-176.

McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'Homme van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. 2012. International Code of Nomenclature for algae, fungi, and plants (Melbourne Code). Regnum Vegetabile 154. 208 p.

Medlin, L.K. & Kaczmarska, I. 2004. Evolution of the diatoms: V. Morphological and cytological support for the major clades and a taxonomic revision. Phycologia 43 (3): 245-270.

Metzeltin, D. & Lange-Bertalot, H. 1998. Tropische Diatomeen in Südamerika I. 700 überwiegend wenig bekannte oder neue Taxa reprasentativ als Elemente der neotropischen Flora [Tropical diatoms of South America I: About 700 predominantly rarely known or new taxa representative of the neotropical flora]. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Diversity-Taxonomy-Geobotany. Koeltz Scientific Books. Königstein. Vol. 5: 695 p.

Metzeltin, D. & Lange-Bertalot, H. 2002. Diatoms from the "Island Continent" Madagascar. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy-Biogeography-Diversity. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 11: 286 p.

Metzeltin, D. & Lange-Bertalot, H. 2007. Tropical diatoms of South America II. Special remarks on biogeography disjunction. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Diversity-Taxonomy-Biogeography. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 18: 877 p.

Metzeltin, D. & Tremarin, P.I. 2011. Uma nova espécie de *Eunotia* para o sudeste do Brasil: *Eunotia fuhrmannii*. Iheringia 66 (2): 201-208.

Metzeltin, D., Lange-Bertalot, H. & García-Rodríguez, F. 2005. Diatoms of Uruguay. Compared with other taxa from South America and elsewhere. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy-Biogeography-Diversity. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 15: 736 p.

Metzeltin, D., Lange-Bertalot, H. & Nergui, S. 2009. Diatoms in Mongolia. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 20: 1-686.

Migula, W. 1907. Kryptogamen-Flora von Deutschland, Deutsch-Osterreich und der Schweiz im Anschluss an Thomé's Flora von Deutschland, Österreich und der Schweiz. (Band VI, Kryptogamen-Flora), Band II. Algen. Teil 1. Cyanophyceae, Diatomaceae, Chlorophyceae. Friedrich von Zezzschwitz, Gera R., 918 p., 43 pls.

Morales, E.A., Vis, M.L., Fernández, E. & Kociolek, J.P. 2007. Epilithic diatoms (Bacillariophyta) from cloud forest and alpine streams in Bolivia, South America II: A preliminary report on the diatoms from Sorata, Department of La Paz. Acta Nova 3 (4): 680-696.

Moreira, I.M.V. 1975. Contribuição ao estudo das Bacillariophyceae (Diatomáceas) em diatomitos brasileiros. Acta Biológica Paranaense 4 (3,4): 135-198.

Moser, G., Lange-Bertalot, H. & Metzeltin, D. 1998. Insel der Endemiten. Geobotanisches Phänomen neukaledonien [Island of endemics. New Caledonia – a geobotanical phenomenon]. Bibliotheca Diatomologica 38: 1-464.

Moutinho, S.O., Garcia, M.J. & De Oliveira, P.E. 2007. Flora diatomácea do reservatório Cabuçu, Município de Guarulhos, (SP): análise qualitativa. Revista UnG, Geociências 6: 32-63.

Müller, O. 1898. Bacillariales aus den Hochseen des Riesengebirges. Forschungsberichte aus der Biologischen Station zu Plön 6: 1-40.

Novitski, L. & Kociolek, P. 2005. Preliminary light and scanning electron microscope observations of marine fossil *Eunotia* species with comments on the evolution of the genus *Eunotia*.

Oliveira, P.E. & Steinitz-Kannan, N. 1992. The diatom flora (Bacillariophyceae) of the Cuyabeno Faunistic Reserve, Ecuadorian Amazonia. Nova Hedwigia 54 (3-4): 515-552.

Oliveira, M.A., Torgan, L.C., Lobo, E.A. & Scharzbold, A. 2001. Association of periphytic diatom species of artificial substrate in lotic environments in the Arroio Sampaio Basin, RS, Brazil: Relationships with abiotic variables. Brazilian Journal of Biology 61 (4): 523-540.

Oliveira, B.D., Nogueira, I.S & Souza, M.G.M. 2012. Eunotiaceae Kützing (Bacillariophyceae) plânctonicas do Sistema Lago dos Tigres, Britânia, GO, Brasil. Hoehnea 39 (2): 297-313.

Ortiz-Lerín, R. & Cambra, J. 2007. Distribution and taxonomic notes of *Eunotia* Ehrenberg 1837 (Bacillariophyceae) in rivers and streams of Northern Spain. Limnetica 26: 415-434.

Patrick, R.M. 1940. Diatoms of Northeastern Brazil. Part I. - Coscinodiscaceae, Fragilariceae and Eunotiaceae. Proceedings of the Academy of Natural Sciences of Philadelphia 92: 191-227.

Patrick, R. 1958. Some nomenclatural problems and a new species and a new variety in the genus *Eunotia* (Bacillariophyceae). Notulae Naturae 312: 1-15.

Patrick, R.M. & Reimer, C.W. 1966. The diatoms of the United States. Exclusive of Alaska and Hawaii. Vol. 1. Fragilariaceae, Eunotiaceae, Achnanthaceae, Naviculaceae. Monographs of the Academy of Natural Sciences of Philadelphia 13: 1-688.

Pavlov, A. & Levkov, Z. 2013. Diversity and distribution of taxa in the genus *Eunotia* Ehrenberg (Bacillariophyta) in Macedonia. Phytotaxa 86 (1): 1-117.

Pearce, C., Cremer, H., Lammertsma, E. & Wagner-Cremer, F. 2013. A 2,500-year record of environmental change in Highlands Hammock State Park (Central Florida, U.S.A.) inferred from siliceous microfossils. Journal of Paleolimnology 49: 31-43.

Qi, Y.Z. & Li, J.Y. 2004. Bacillariophyta. Pennatae (Araphidiales Raphidionales). In: Flora algarum sinicarum aquae dulcis. Tomus X: 1-161. Science Press, Beijing.

Reichardt, E. 1995. Die Diatomeen (Bacillariophyceae) in Ehrenberg's material von Cayenne, Guyana Gallica (1843). In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein. Vol. 1: 7-99.

Rodrigues, L. & Moreira-Filho, H. 1990. Diatomoflórula do Rio Tubarão, Santa Catarina, Brasil: I Eunotiaceae Kützing e Achnanthaceae Kützing. Insula 20: 113-135.

Round, F.E., Crawford, R.M. & Mann, D.G. 1990. The Diatoms. Biology and morphology of the genera. Cambridge University Press, Cambridge. 747 p.

Rumrich, U., Lange-Bertalot, H. & Rumrich, M. 2000. Diatoms of the Andes from Venezuela to Patagonia/Tierra del Fuego. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein. Vol. 9: 1-649.

Ryu, E. 2005. Late Quaternary diatom assemblages from the Ulleung Basin, East Sea. Journal of the Paleontological Society of Korea 21 (1): 23-139.

Sala, S.E., Duque, S.R., Núnez-Avellaneda, M. & Lamaro, A.A. 2002. Diatoms from the Colombian Amazon: Some species of the genus *Eunotia* (Bacillariophyceae). Acta Amazonica 32 (4): 589-603.

Sar, E.A., Sala, S.E., Sunesen, I., Henninger, M.S. & Montastruc, M. 2009. Catálogo de los géneros, especies y taxa infraespecíficos erigidos por J. Frenguelli/Catalogue of the genera, species, and infraspecific taxa erected by J. Frenguelli. Diatom Monographs 10: 1-419.

Schaarschmidt, G. 1881. Algae in A Kanitz, Plantas Romaniae hucusque cognitas. Magyar Novenytani Lapok 5: 151-165, 261-268.

Schmidt, A. 1913. Atlas der Diatomaceen-kunde. Leipzig. O.R. Reisland Series III (Heft 72): pls 241-336 [F. Hustedt].

Schneck, F., Torgan, L.C. & Schwarzbold, A. 2008. Diatomáceas epilíticas em riacho de altitude no Sul do Brasil. Rodriguésia 59 (2): 325-338.

Silva, P.C. 1962. Classification of algae. In Lewin R.A. (ed.) Physiology and Biochemistry of Algae. Academic Press, New York. p. 827-837.

Silva, A.M., Ludwig, T.A.V., Tremarin, P.I. & Vercellino, I.S. 2010. Diatomáceas perifíticas em um sistema eutrófico brasileiro (Reservatório do Iraí, estado do Paraná). Acta Botanica Brasilica 24 (4): 997-1016.

Silva, W.J., Jahn, R. & Menezes, M. 2012. Diatoms from Brazil: the taxa recorded by Christian Gottfried Ehrenberg. PhytoKeys 18: 19-37.

Simonsen, R. 1987. Atlas and catalogue of the diatom types of Friedrich Hustedt. Vol. 1: 525 pp., Vol. 2: pls 1-395, Vol. 3: pls 396-772. J. Cramer, Gebrüder Borntraeger, Berlin & Stuttgart.

Siver, P.A. & Hamilton, P.B. 2011. Diatoms of North America: The freshwater flora of waterbodies on the Atlantic Coastal Plain. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein. Vol. 22: 1-916.

Siver, P.A. & Wolfe, A. 2007. *Eunotia* spp. (Bacillariophyceae) from Middle Eocene lake sediments and comments on the origin of the diatom raphe. Canadian Journal of Botany 85: 83-90.

Siver, P.A., Hamilton, P.B., Stachura-Suchoples, K. & Kociolek, J.P. 2005. Diatoms of North America: The freshwater flora of Cape Cod, Massachusetts, U.S.A. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Taxonomy. Koeltz Scientific Books. Königstein. Vol. 14: 1-463.

Siver, P.A., Hamilton, P.B. & Morales, E.A. 2006. Two new planktic species of *Eunotia* (Bacillariophyceae) from freshwater waterbodies in North Carolina, U.S.A.

Souza, M.G.M & Compère, P. 1999. New diatom species from the Federal District of Brazil. Diatom Research 14 (2): 357-366.

Souza, M.G.M & Moreira-Filho, H. 1999. Diatoms (Bacillariophyceae) of two aquatic macrophyte banks from Lagoa Bonita, Distrito Federal, Brazil, I: Thalassiosiraceae and Eunotiaceae. Bulletin du Jardin botanique national de Belgique 67 (1/4): 259-278.

Souza, G.S., Koening, M.L., Leça, E.E. & Coêlho, M.P.C.A. 2007. Diatomáceas indicadoras de paleoambientes do Quartenário de Dois Irmãos, Recife, PE, Brasil. Acta Botânica Brasílica 21 (3): 521-529.

Souza-Mosimann, R.M. 1982. Diatomáceas da Represa do Córrego Grande (Poção) Florianópolis – Santa Catarina – Brasil (Crysophyta Bacillariophyceae). Ínsula 12: 1-38.

Souza-Mosimann, R.M., Tavares, A.S. & Freitas, V.P. 1997. Contribuição ao conhecimento da diatomoflórula do conteúdo estomacal de algumas espécies de peixes da Amazônia. I. *Myleus* sp. (Pacu) do Lago do Prato, AM., Brasil. Acta Amazonica 27: 9-26.

Taylor, J.C., Harding, W.R. & Archibald, G.M. 2007. An Illustrated Guide to Some Common Diatom Species from South Africa. WRC Report TT 282/07. Water Research Commission, Pretoria. 178 pls.

ter Braak, D.J.F & Van Dam, H. 1989. Inferring pH from diatoms: a comparison of old and new calibration methods. Hydrobiologia 178: 209-223.

Toledo, L. & Comas, A. 2009. Sinopsis Taxonómica de la Familia Eunotiaceae Ehrenberg (Eunotiaceae Kütz. 1844, Bacillariophyceae) de Cuba. Boletin de La Sociedad Española de Ficología 41: 7-12.

Torgan, L.C. 1985. Estudo taxonômico de diatomáceas (Bacillariophyceae) da represa de Águas Belas, Viamão, Rio Grande do Sul, Brasil. Iheringia 33: 17-104.

Tremarin, P.I., Ludwig, T.A.V. & Moreira Filho, H. 2008. *Eunotia* Ehrenberg (Bacillariophyceae) do rio Guaraguaçu, litoral do Paraná, Brasil. Acta Botanica Brasilica 22 (3): 845-862.

Van Dam, H., Mertens, A. & Sinkeldam, J. 1994. A coded checklist and ecological indicator values of freshwater diatoms from the Netherlands. Netherlands Journal of Aquatic Ecology 28: 117-133.

Van de Vijver, B, Beyens, L. & Lebouvier, M. 2008. The genus *Eunotia* on the volcanic island, Île Amsterdam (Southern Indian Ocean). Nova Hedwigia 87 (1-2): 113-128.

Van de Vijver, B., de Haan, M. & Lange-Bertalot, H. 2014. Revision of the genus *Eunotia* (Bacillariophyta) in the Antartic Region. Plant Ecology and Evolution 147 (2): 256-284.

Van Heurck, H. 1881. Synopsis des Diatomées de Belgique. Atlas. Ducaju & Cie., Anvers.

Vanormelingen, P., Chepurnov, V., Mann, D.G., Saabe, K. & Vyverman, W. 2008. Genetic divergence and reproductive barriers among morphologically heterogeneous sympatric clones of *Eunotia bilunaris* sensu lato (Bacillariophyta). Protist 159: 73-90.

Veselá, J. & Johansen, J.R. 2009. The Diatom Flora of ephemeral headwater streams in the Elbsandsteingebirge region of the Czech Republic. Diatom Research 24 (2): 443-477.

Vyverman, W. 1991. Diatoms from Papua New Guinea. Bibliotheca Diatomologica 22: 1-225, 208 pls.

Vyverman, W., Vyverman, R., Hodgson, D. & Tyler, P. 1995. Diatoms from Tasmanian mountain lakes: a reference data-set (TASDIAT) for environmental reconstruction and a systematic and autecological study. Bibliotheca Diatomologica 33: 1-193.

Wengrat, S. & Bicudo, D.C. 2011. Spatial evaluation of water quality in an urban reservoir (Billings Complex, southeastern Brazil). Acta Limnologica Brasiliensia 23 (2): 200-216.

Wengrat, S., Marquardt, G.C., Bicudo, D.C., Bicudo, C.E.M., Wetzel, C.E. & Ector, L. 2015. Type analysis of *Cymbella schubartii* and two new *Encyonopsis* species (Bacillariophyceae) from southeastern Brazil. Phytotaxa 221 (3): 247-264.

Werum, M. & Lange-Bertalot, H. 2004. Diatoms in springs from Central Europe and elsewhere under the influence of hydrologeology and anthropogenic impacts. Diatomeen in Quellen unter hydrogeologischen und anthropogenen Einflüssen in Mitteleuropa und anderen Regionen. In: Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Ecology-Hydrogeology-Taxonomy. A.R.G. Gantner Verlag K.G., Ruggell. Vol. 13: 417 p.

Wetzel, C.E. & Ector, L. 2014. Taxonomy, distribution and autecology of *Planothidium bagualensis* sp. nov. (Bacillariophyta) a common monoraphid species from southern Brazilian rivers. Phytotaxa 156 (4): 201-210.

Wetzel, C.E., Ector, L., Hoffmann, L. & Bicudo, D.C. 2010. Colonial planktonic *Eunotia* (Bacillariophyceae) from Brazilian Amazon: Taxonomy and biogeographical considerations on the *E. asterionelloides* species complex. Nova Hedwigia 91 (1-2): 49-86.

Wetzel, C.E., Ector, L., Hoffmann, L., Lange-Bertalot, H. & Bicudo, D.C. 2011. Two new periphytic *Eunotia* species from the neotropical Amazonian 'black waters', with a type analysis of *E. braunii*. Diatom Research 26: 135-146.

Wojtal, A., Witkowski, A. & Metzeltin, D. 1999. The diatom flora of the "Bór na Czerwonem" raised peat-bog in the Nowy Targ Basin (Southern Poland). Fragmenta Floristica et Geobotanica 44: 167-192.

Wydrzycka, U. & Lange-Bertalot, H. 2001. Las diatomeas (Bacillariophyceae) acidófilas del río Agrio y sitios vinculados con su cuenca, volcán Poás, Costa Rica. Brenesia 55-56: 1-68.

Zimmermann, C. 1915. II. Contribuição para o estudo das diatomaceas dos estados unidos do Brazil. Broteria (Serie Botanica) 13: 37-56, pls 4-7.

Plate 1

Scale Bar = 10 µm

Figs 1-6. ***Eunotia transfuga*** Metzeltin & Lange-Bertalot

Figs 1-5 Paraitinga reservoir, periphyton. (SP427985)

Fig. 6. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 1-6. Morphometry: Apical axis 75.5-167.9 µm; Transapical axis 5.5-8.8 µm; Striae 15-19 in 10 µm.

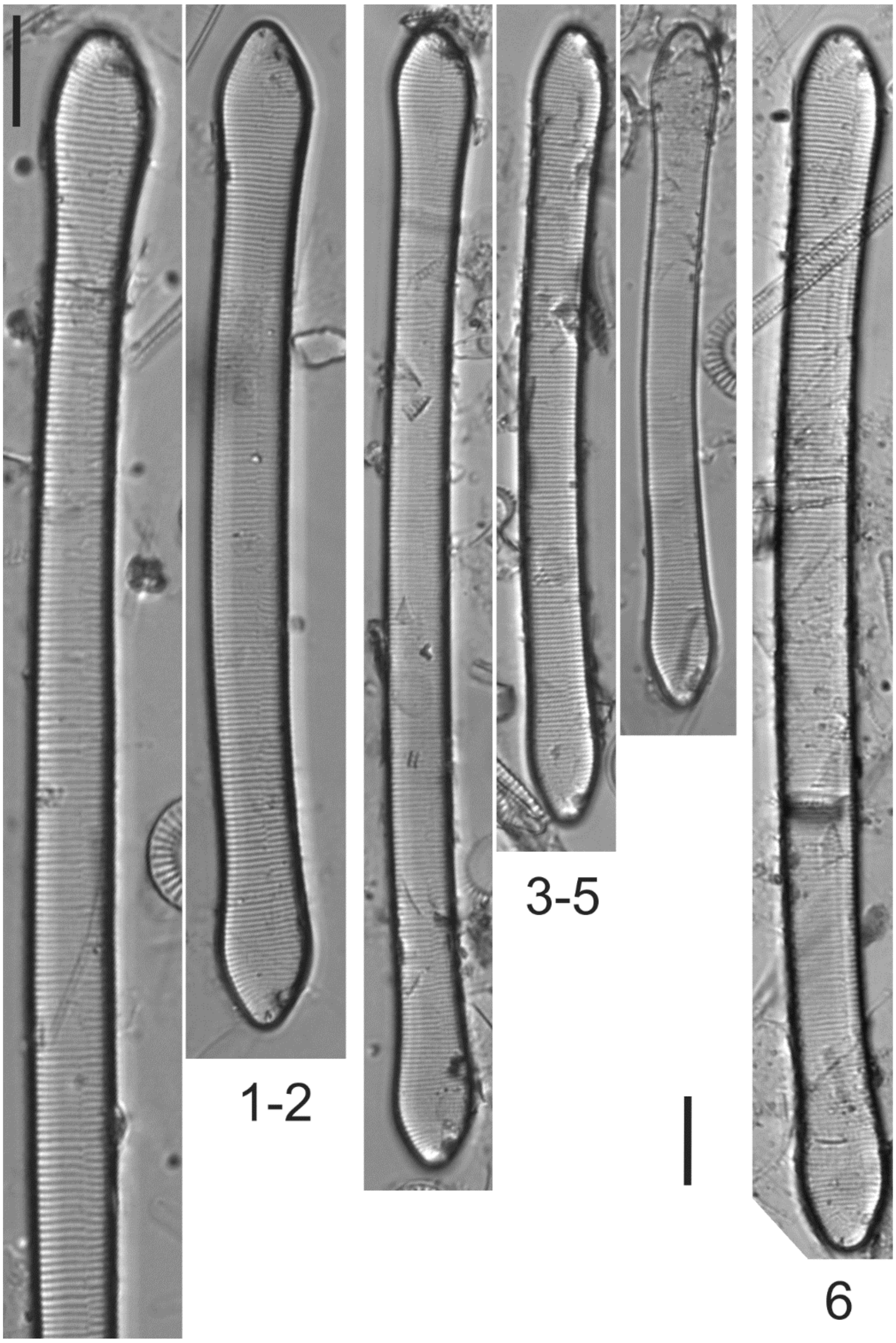

1-2
3-5
6

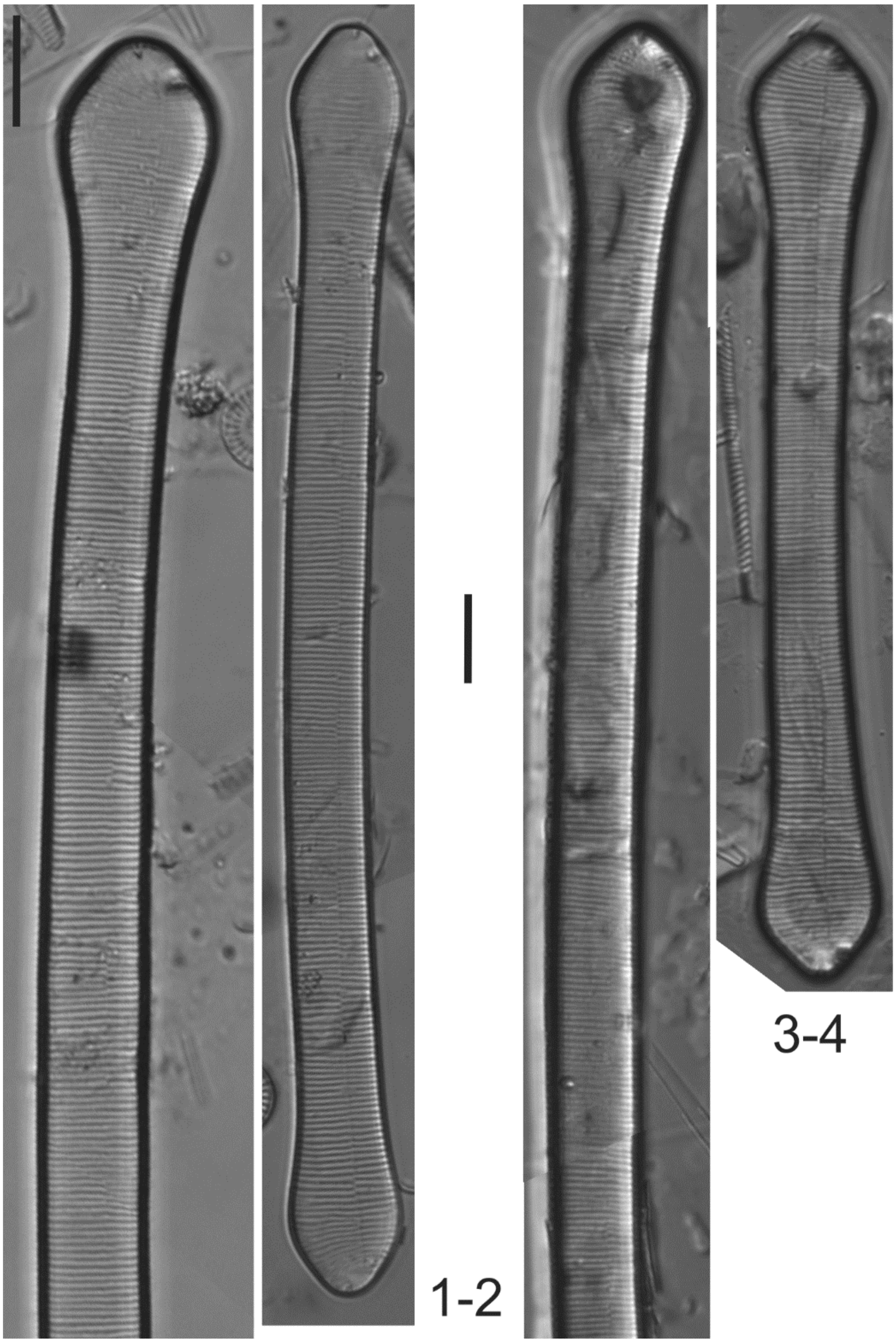
Plate 2

Scale Bar = 10 µm

Figs 1-4. ***Desmogonium ossiculum*** Metzeltin & Lange-Bertalot

Figs 1-2. Paraitinga reservoir, periphyton. (SP427985)
Figs 3-4. Paiva Castro reservoir, periphyton. (SP469379)

Figs 1-4. Morphometry: Apical axis 107.2-184.3 µm; Transapical axis 8.5-10.3 µm; Striae 14-17 in 10 µm.



1-2

3-4

Plate 3

Scale Bar = 50 µm: Fig. 1; **40 µm**: Fig. 5; **5 µm**: Figs 2-4, 6-7

Figs 1-3. *Desmogonium ossiculum* Metzeltin & Lange-Bertalot

Figs 4-7. *Eunotia transfuga* Metzeltin & Lange-Bertalot

Figs 1-3. Paiva Castro reservoir, periphyton. (SP469379)

Fig. 4. Ponte Nova reservoir, periphyton. (SP427983)

Figs 5-7. Paraitinga reservoir, periphyton. (SP427985)

Fig. 1. External valve view.

Figs 2-4. External detail of valve view showing raphe, spines and rimoportula.

Fig. 5. Internal valve view.

Figs 6-7. Internal detail of valve view showing helictoglossae and rimoportula.

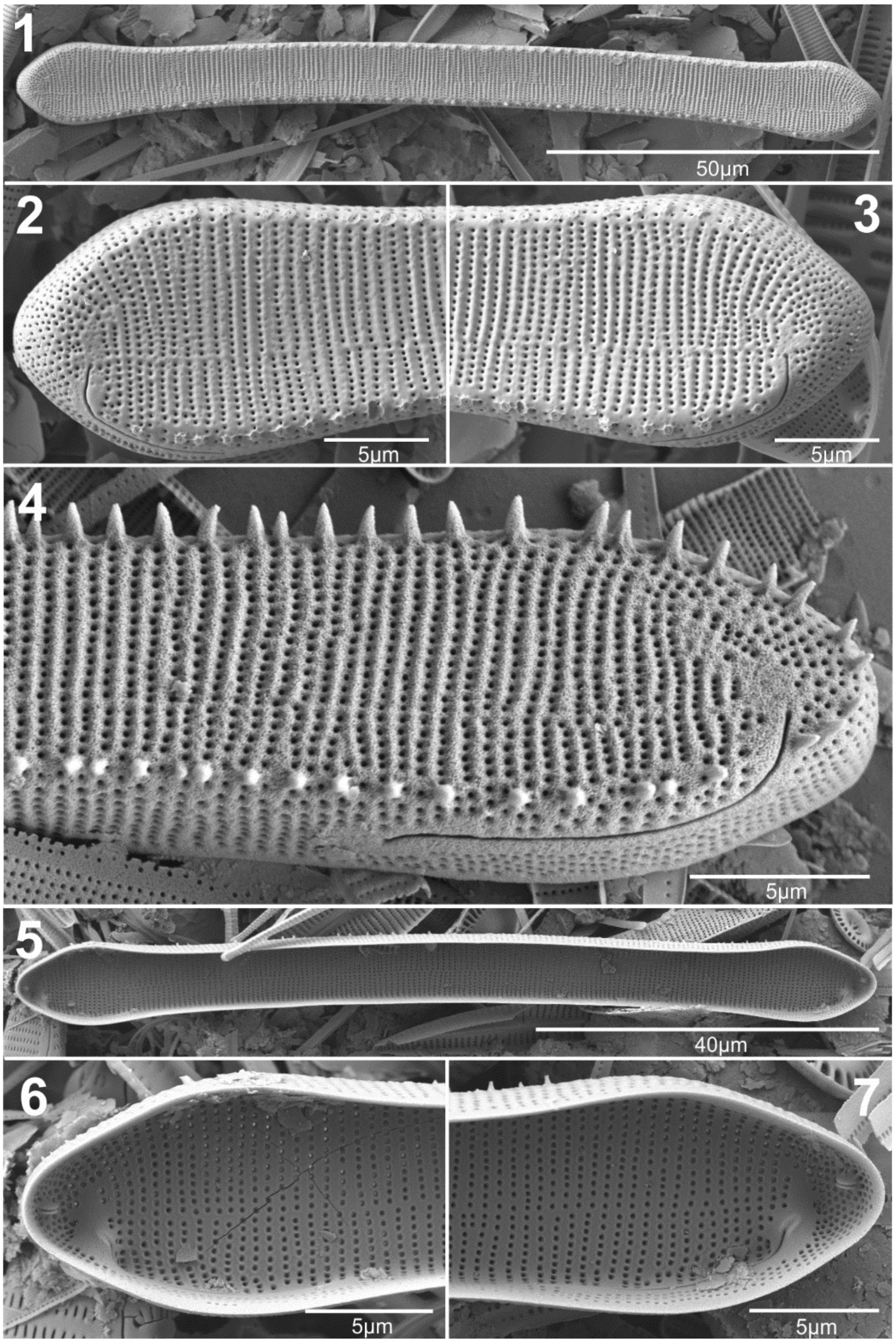

1
50µm
2
3
5µm
5µm
4
5µm
5
40µm
6
7
5µm
5µm

Plate 4

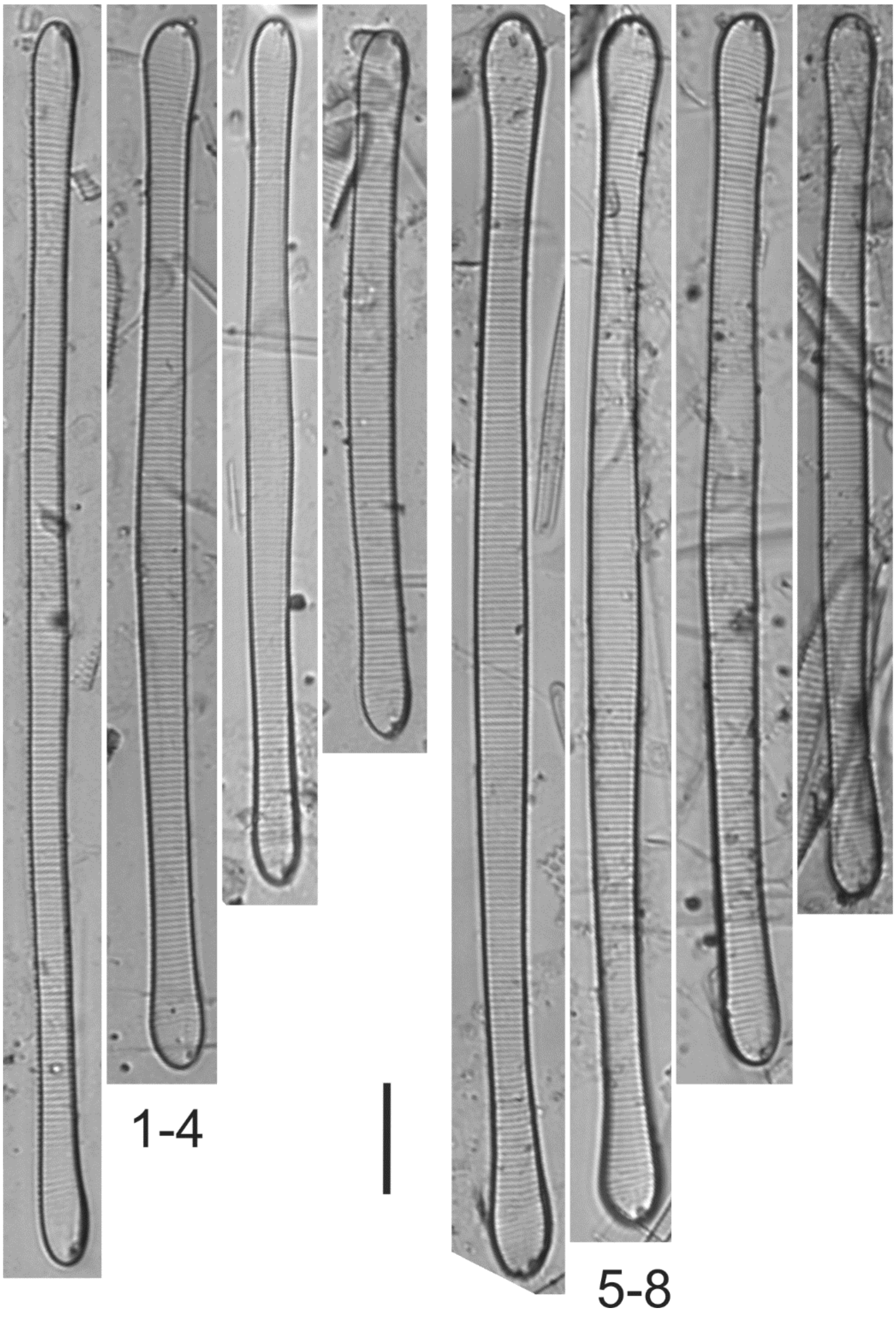
Scale Bar = 10 µm

Figs 1-8. *Eunotia desmogonioides* Metzeltin & Lange-Bertalot

Figs 1-4. Ponte Nova reservoir, periphyton. (SP427983)

Figs 5-8. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 1-8. Morphometry: Apical axis 63.8-114 µm; Transapical axis 3.3-4.8 µm; Striae 17-19 in 10 µm.



1-4

5-8

Plate 5

Scale Bar = 50 µm: Fig. 1; **5 µm**: Figs 2-4

Figs 1-4. *Eunotia desmogonioides* Metzeltin & Lange-Bertalot

Figs 1-4. Taiaçupeba reservoir, periphyton. (SP427987)

Fig. 1. External and internal valve view.

Figs 2-3. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 4. External detail of valve view showing raphe.

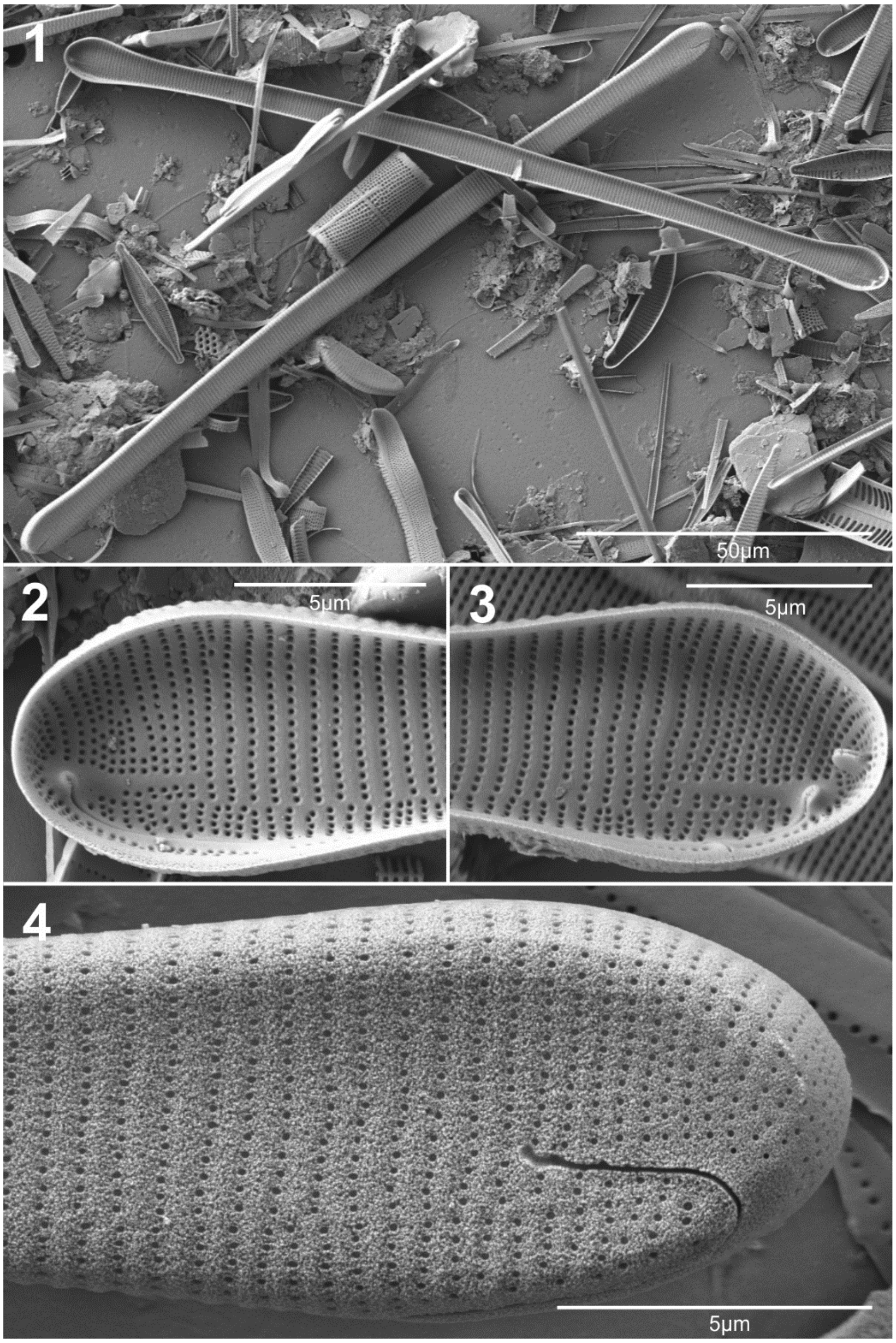

1
50µm
2
5µm
3
5µm
4
5µm

Plate 6

Scale Bar = 50 µm: Figs 1-2; **5 µm**: Figs 3-4

Figs 1-4. ***Eunotia desmogonioides*** Metzeltin & Lange-Bertalot

Figs 1-4. Ponte Nova, periphyton. (SP427983)

Fig. 1. Internal valve view.

Fig. 2. External valve view.

Fig. 3. External detail of valve view showing raphe.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

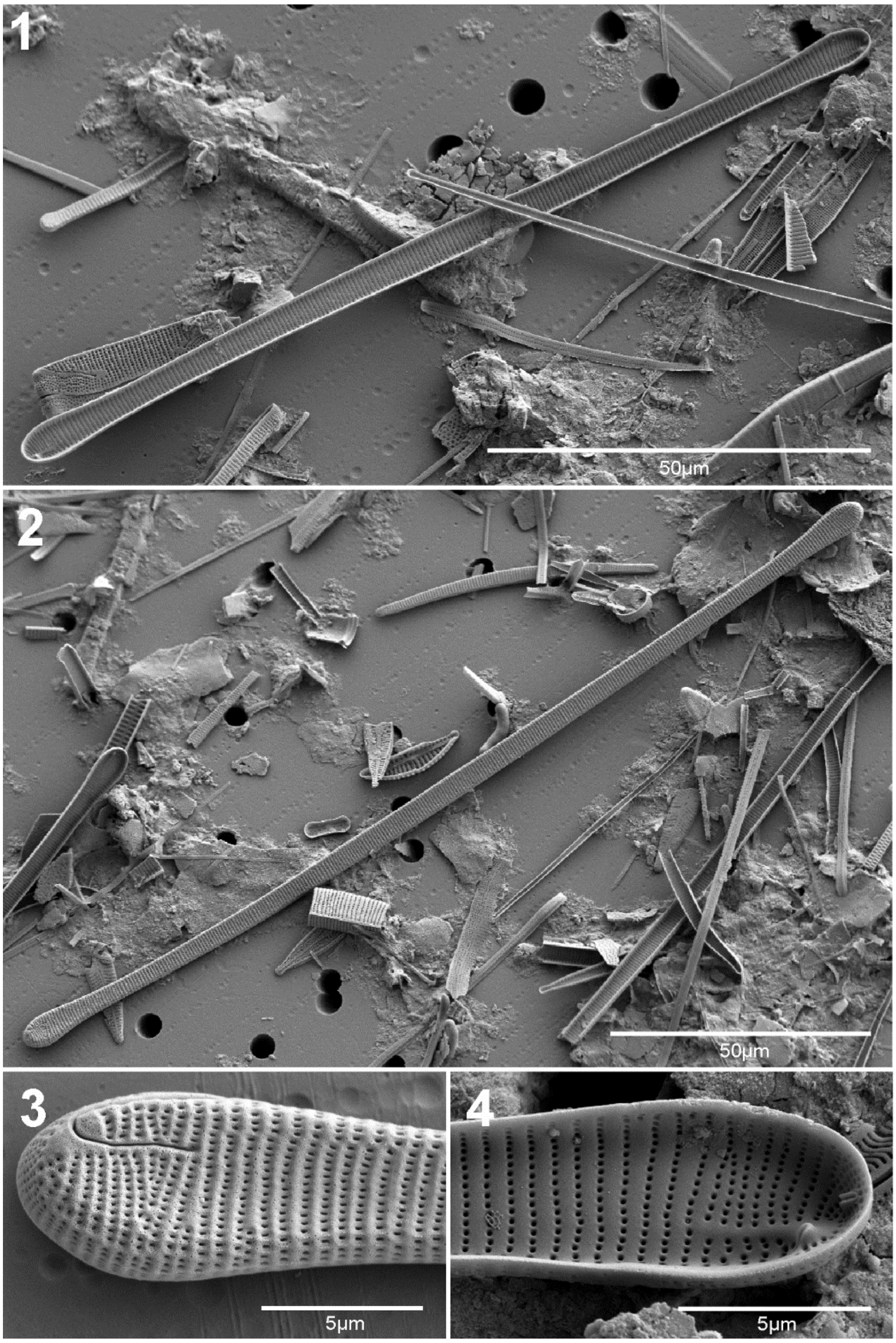

1
50µm
2
50µm
3
5µm
4
5µm

Plate 7

Scale Bar = 10 µm

Figs 1-7. *Eunotia mesiana* Cholnoky

Figs 1-4. Paiva Castro reservoir, periphyton. (SP469369)

Figs 5-7. Tatu reservoir, periphyton. (SP469376)

Figs 1-7. Morphometry: Apical axis 117.8-200.4 µm; Transapical axis 4.7-5.2 µm; Striae 16-17 in 10 µm.

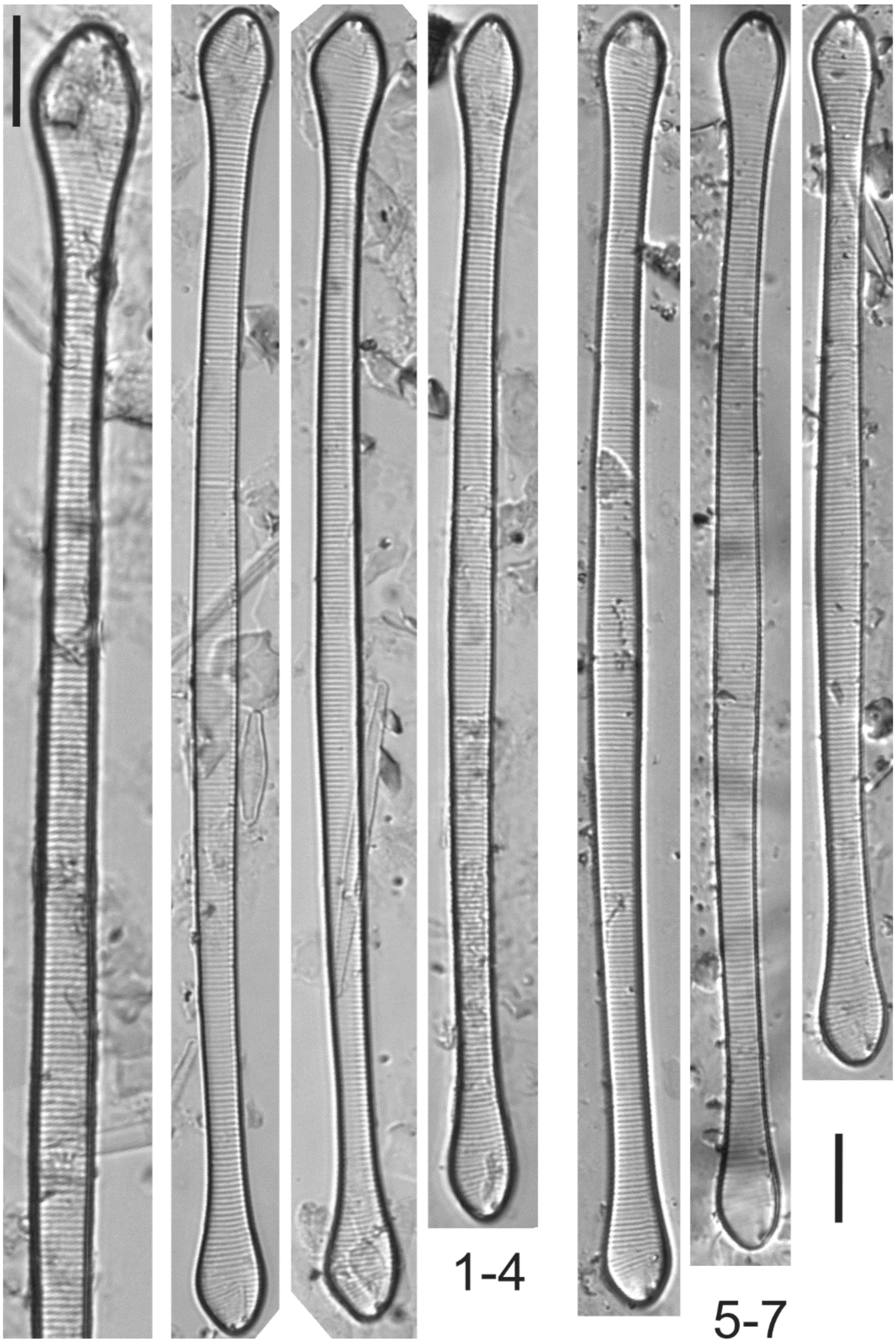

1-4
5-7

Plate 8

Scale Bar = 50 µm: Fig. 1; **5 µm**: Figs 2-5

Figs 1-5. ***Eunotia mesiana*** Cholnoky

Figs 1-5. Paiva Castro reservoir, periphyton. (SP469369)

Fig. 1. External valve view.

Figs 2-3. External detail of valve view showing raphe.

Figs 4-5. Internal detail of valve view showing helictoglossae and rimoportula.

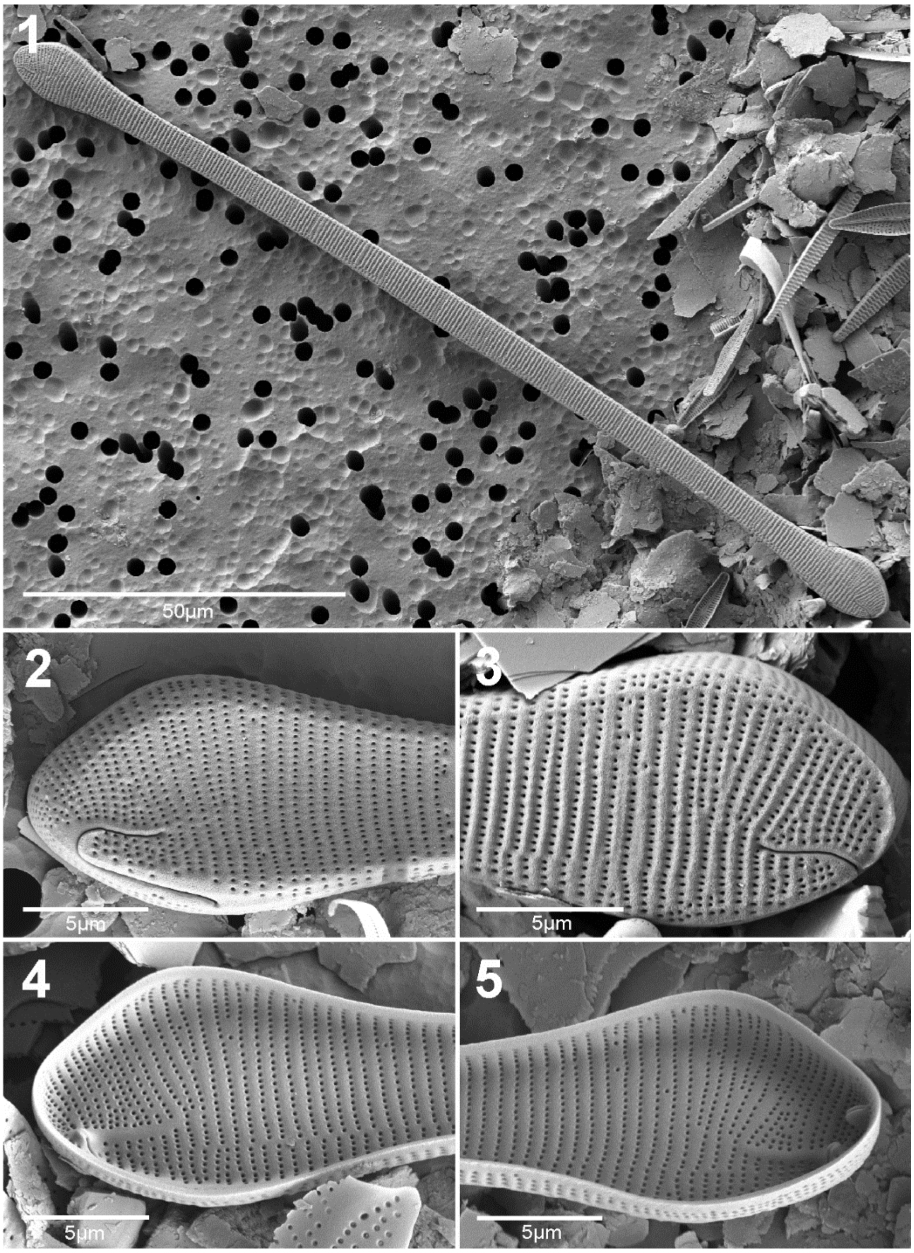

1
50µm
2
5µm
3
5µm
4
5µm
5
5µm

Plate 9

Scale Bar = 10 µm

Figs 1-6. *Eunotia roland-schmidtii* Metzeltin & Lange-Bertalot

Figs 1-2. Pedro Beicht reservoir, surface sediment. (SP427582)

Figs 3-6. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 1-6. Morphometry: Apical axis 84.1-125.7 µm; Transapical axis 5-6.5 µm; Striae 11-12 in 10 µm.

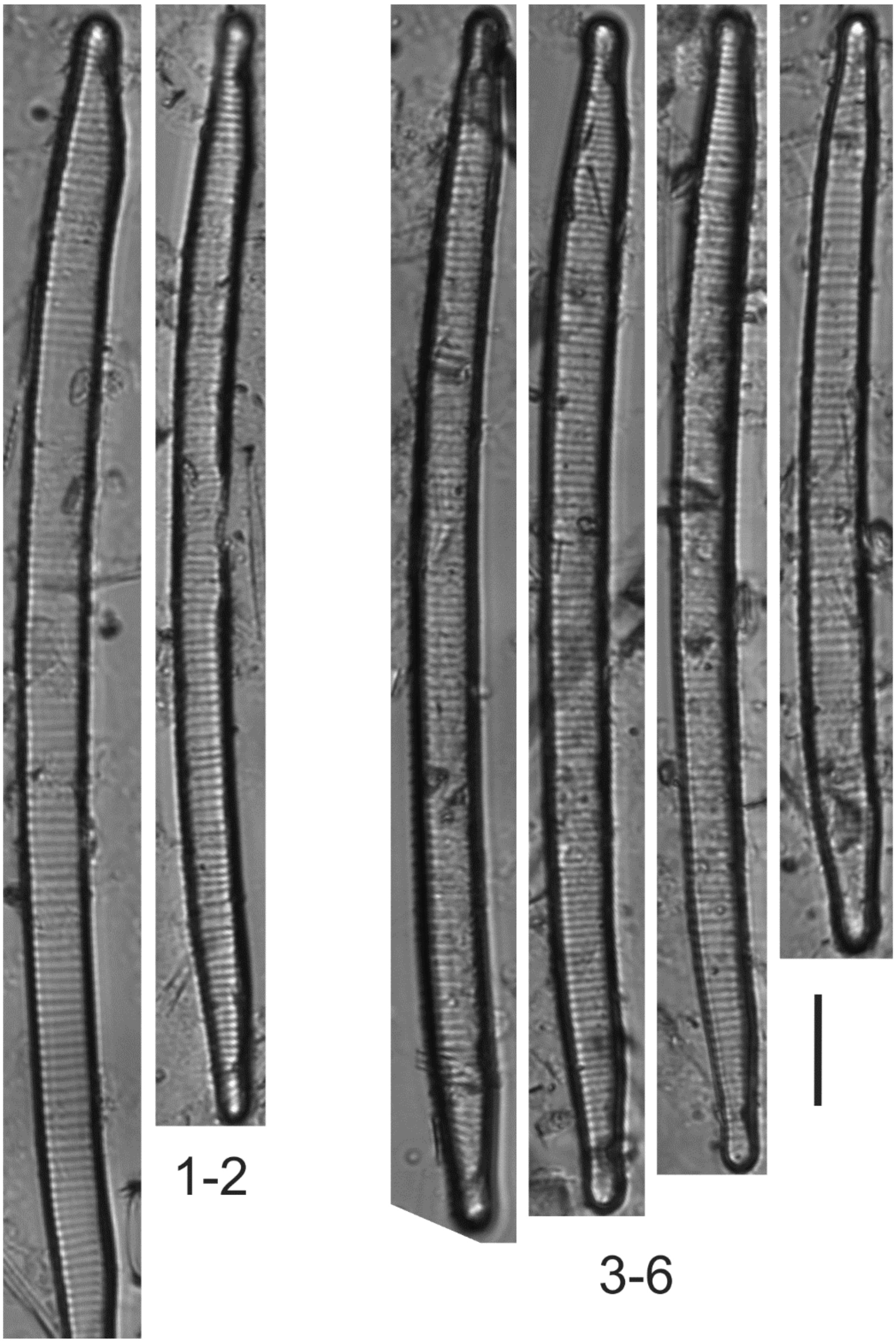

1-2
3-6

Plate 10

Scale Bar = 10 µm

Figs 1-7. *Eunotia bilunaris* (Ehrenberg) Schaarschmidt

Figs 1-4. Paraitinga reservoir, periphyton. (SP427985)

Figs 5-7. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-7. Morphometry: Apical axis 48.5-172 µm; Transapical axis 3.3-4.1 µm; Striae 13-15 in 10 µm.

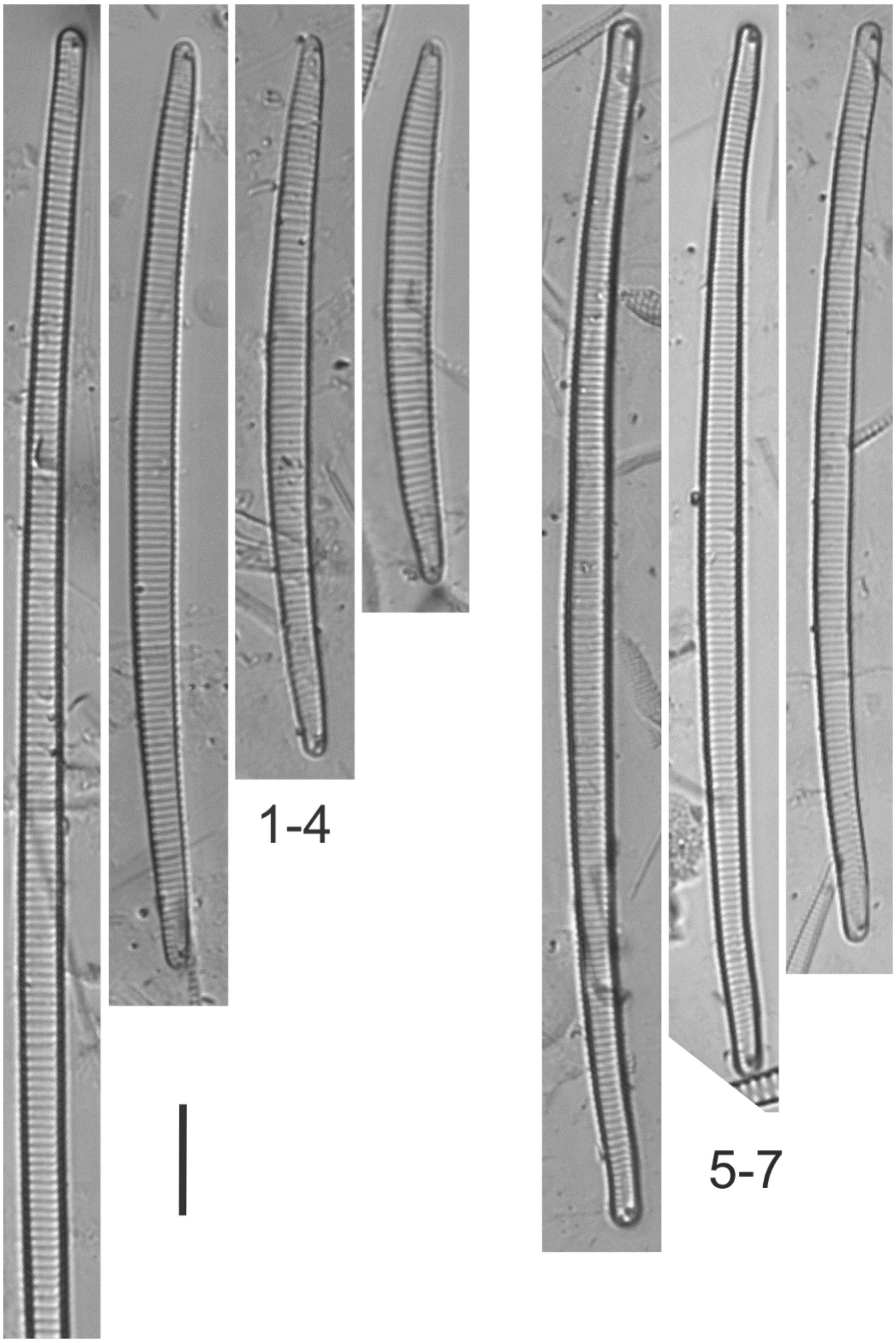

1-4
5-7

Plate 11

Scale Bar = 10 µm

Figs 1-15. *Eunotia juettnerae* Lange-Bertalot

Figs 1-9. Ponte Nova reservoir, periphyton. (SP427983)

Figs 10-15. Tanque Grande reservoir, periphyton. (SP428932)

Figs 1-15. Morphometry: Apical axis 20.5-99.7 µm; Transapical axis 2.5-3.1 µm; Striae 17-20 in 10 µm.

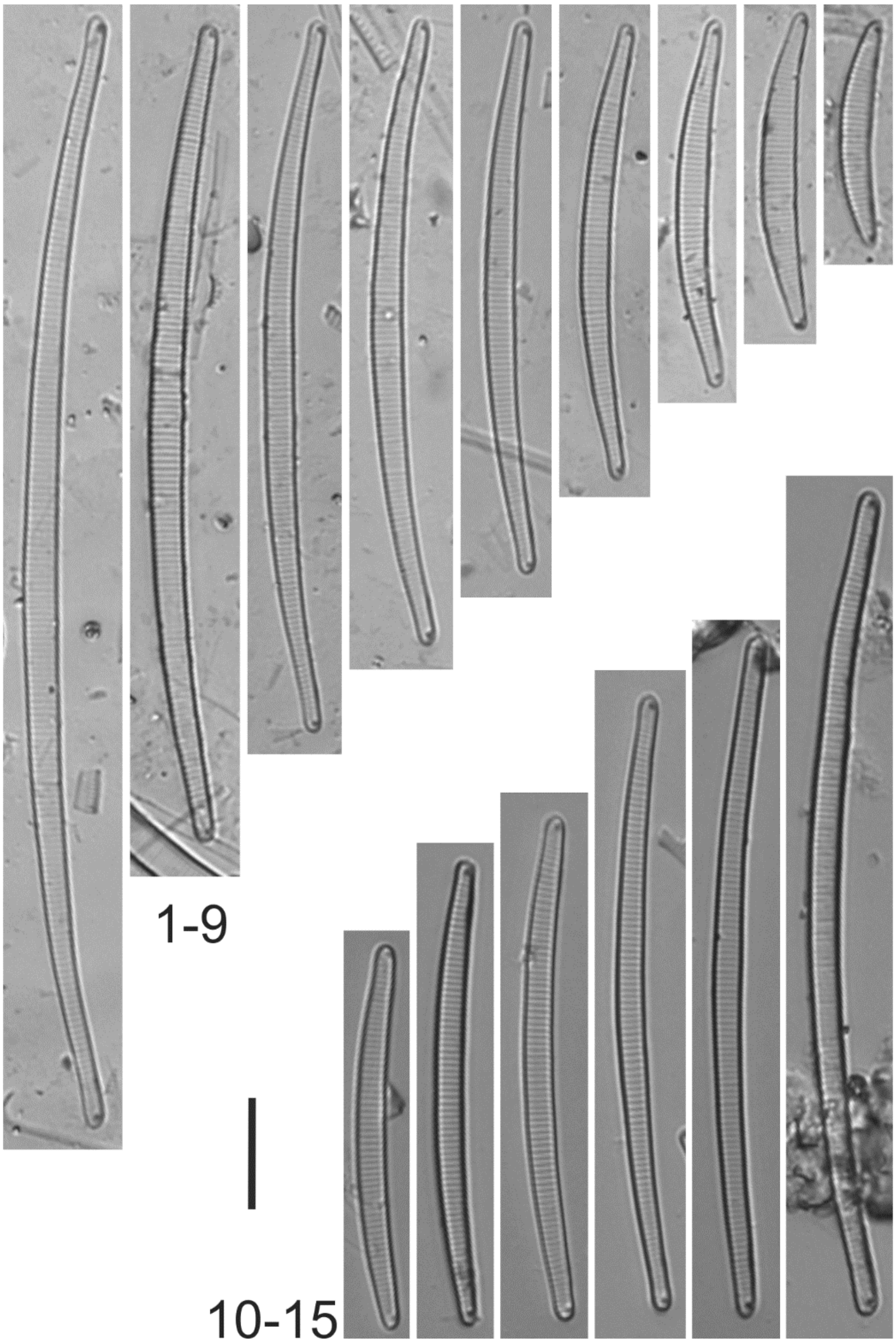

1-9
10-15

Plate 12

Scale Bar = 50 µm: Fig. 1; **30 µm**: Fig. 2; **5 µm**: Figs 3, 5; **4 µm**: Fig. 4

Figs 1-4. *Eunotia bilunaris* (Ehrenberg) Schaarschmidt

Fig. 5. *Eunotia roland-schmidtii* Metzeltin & Lange-Bertalot

Figs 1-4. Ponte Nova reservoir, periphyton. (SP427983)

Fig. 5. Pedro Beicht, reservoir, surface sediment. (SP427581)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. External detail of valve view showing raphe.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 5. External detail of valve view showing raphe and spines.

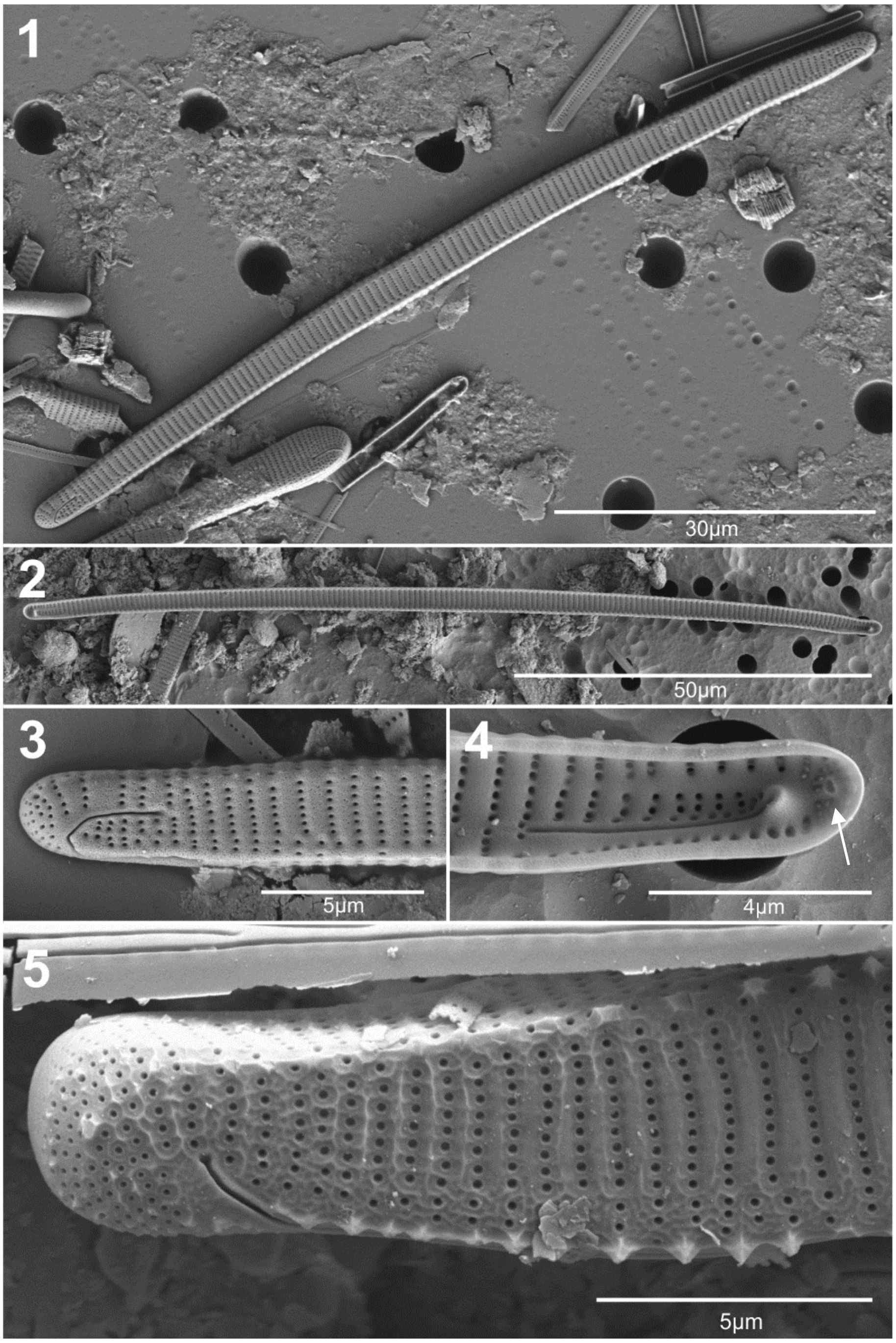

1
30µm
2
50µm
3
5µm
4
4µm
5
5µm

Plate 13

Scale Bar = 10 µm

Figs 1-13. *Eunotia naegelii* Migula

Figs 1-6. Pedro Beicht reservoir, periphyton. (SP469560)

Figs 7-13. Ribeirão do Campo reservoir, periphyton. (SP427928)

Figs 1-13. Morphometry: Apical axis 39.3-90.9 µm; Transapical axis 1.9-2.5 µm; Striae 21-23 in 10 µm.

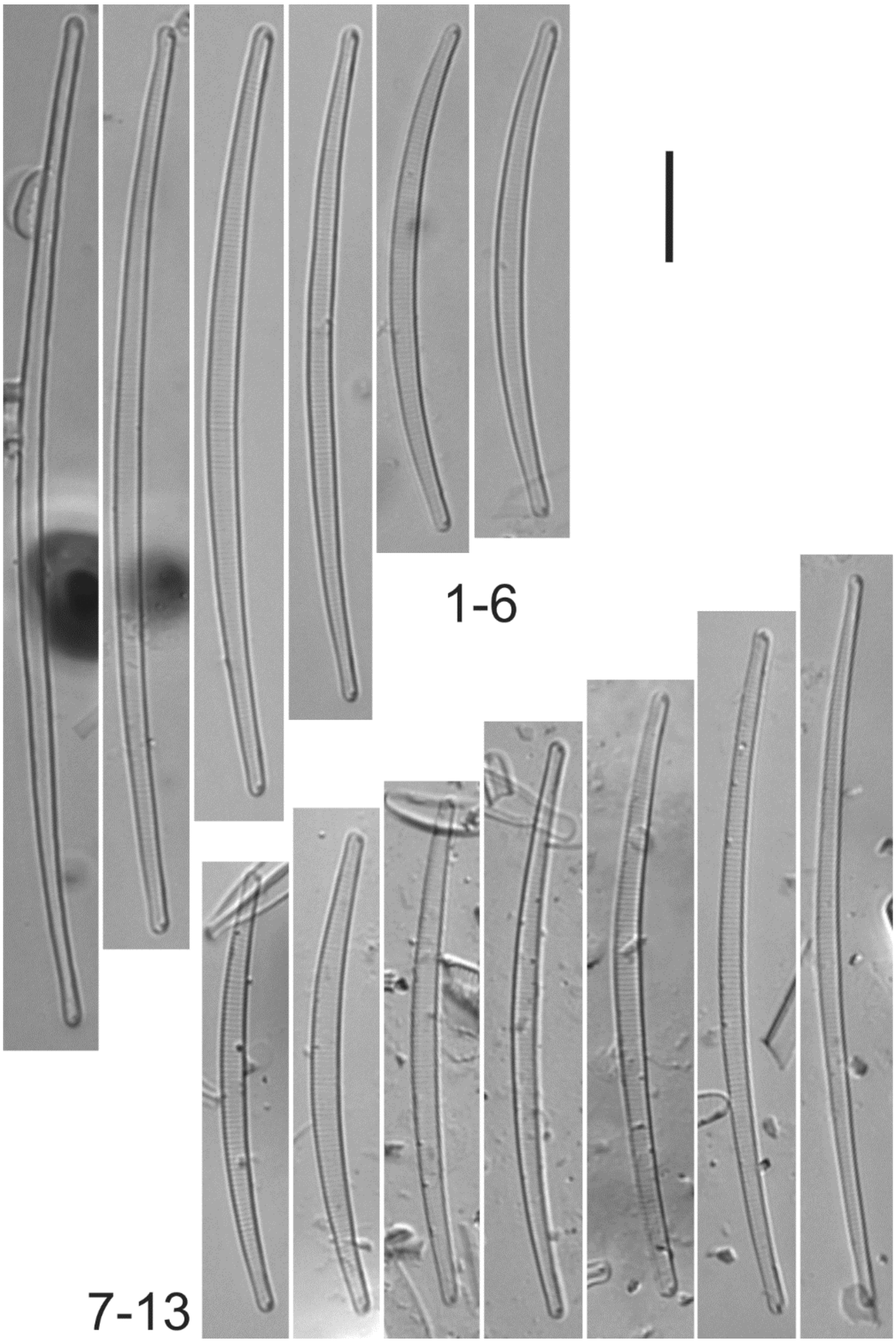

1-6
7-13

Plate 14

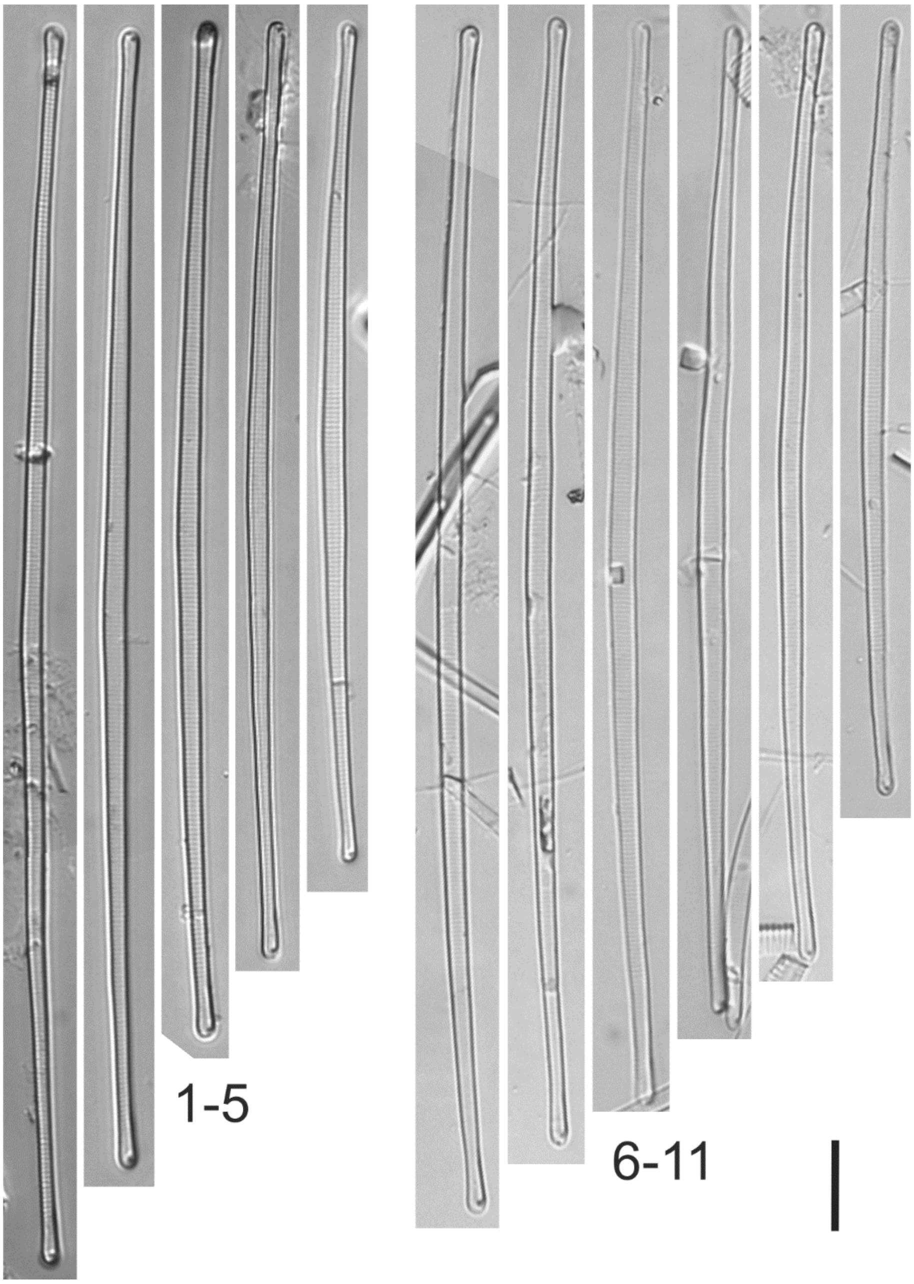
Scale Bar = 10 µm

Figs 1-11. *Eunotia genuflexa* Nörpel-Schempp

Figs 1-5. Lago das Ninféias reservoir, periphyton. (SP469317)

Figs 6-11. Billings reservoir, periphyton. (SP427902)

Figs 1-11. Morphometry: Apical axis 84.2-136.7 µm; Transapical axis 2.2-3 µm; Striae 20-22 in 10 µm.



1-5
6-11

Plate 15

Scale Bar = 10 µm

Figs 1-20. *Eunotia mucophila* (Lange-Bertalot & Nörpel-Schempp) Lange-Bertalot

Figs 1-8. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 9-13. Pedro Beicht reservoir, periphyton. (SP469560)

Figs 14-20. Ribeirão do Campo reservoir, periphyton. (SP427928)

Figs 1-20. Morphometry: Apical axis 16.9-58.3 µm; Transapical axis 2.1-2.9 µm; Striae 21-23 in 10 µm.

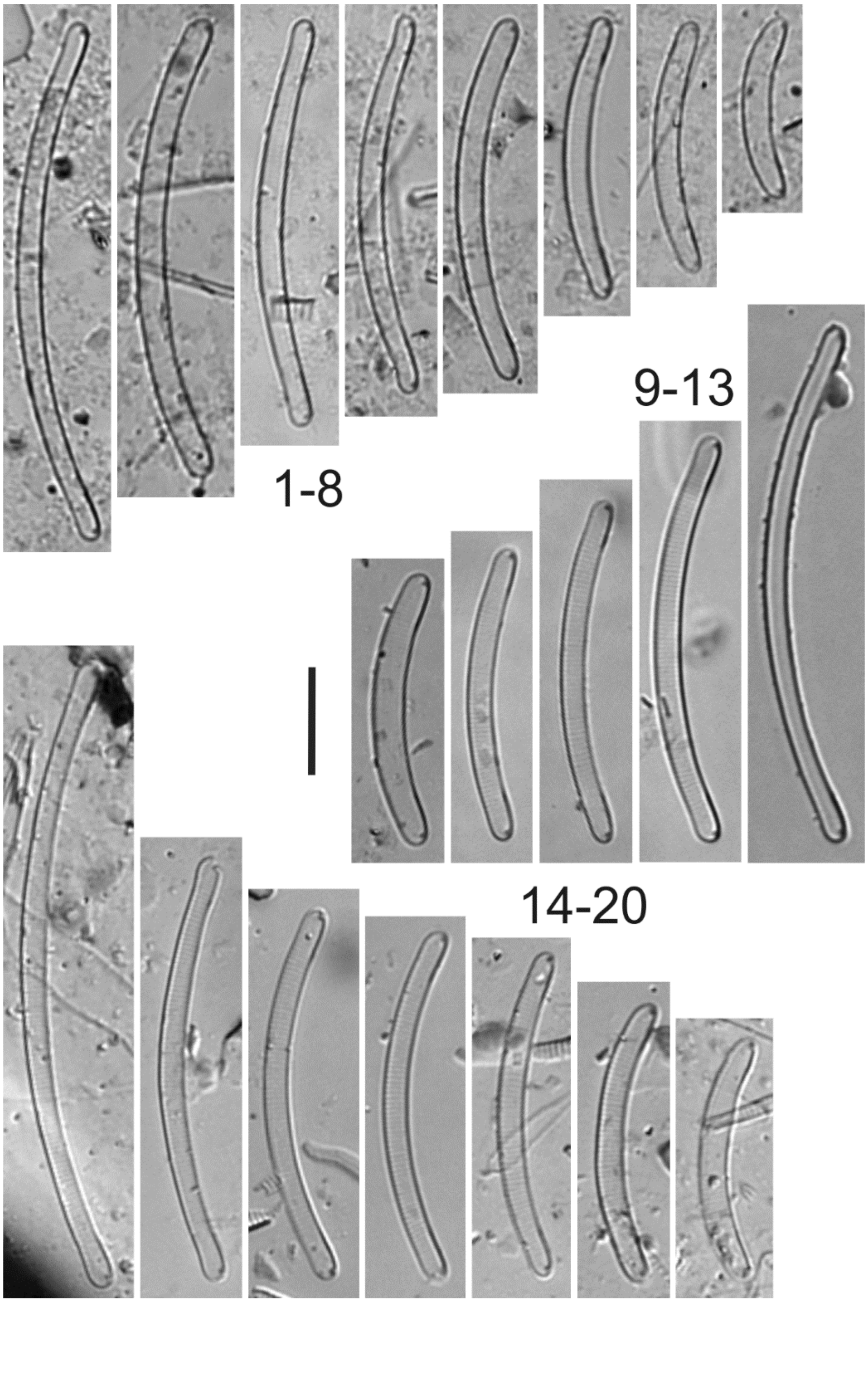

1-8
9-13
14-20

Plate 16

Scale Bar = 10 µm: Fig. 1; **5 µm**: Fig. 3; **4 µm**: Fig. 2; **2 µm**: Fig. 4

Figs 1-4. *Eunotia mucophila* (Lange-Bertalot & Nörpel-Schempp) Lange-Bertalot

Figs 1-4. Pedro Beicht reservoir, phytoplankton. (SP427595)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe.

Fig. 3. Internal valve view.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

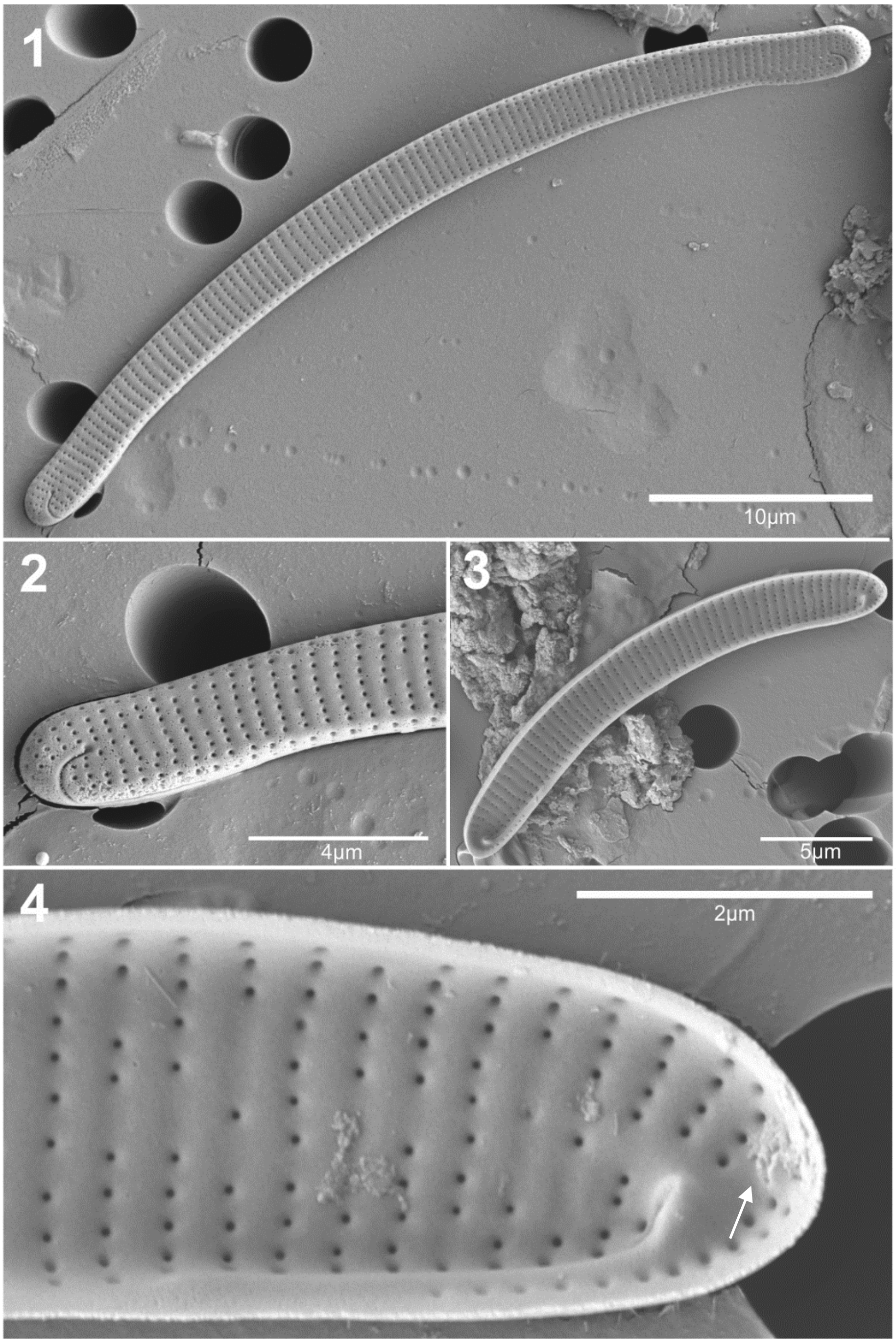

1
10µm
2
4µm
3
5µm
4
2µm

Plate 17

Scale Bar = 10 µm

Figs 1-10. *Eunotia paludosa* Grunow

Figs 11-13. *Eunotia* sp. 1

Figs 14-30. *Eunotia subarcuatoides* Alles, Nörpel & Lange-Bertalot

Figs 1-5. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 6-10. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 11-16. Billings reservoir, surface sediment. (SP401589)

Figs 17-20. Pedro Beicht reservoir, phytoplankton. (SP427587)

Figs 21-24. Billings reservoir, periphyton. (SP427902)

Figs 25-30. Ribeirão do Campo reservoir, phytoplankton. (SP427918)

Figs 1-10. Morphometry: Apical axis 21.9-38.8 µm; Transapical axis 2.3-3.1 µm; Striae 19-21 in 10 µm.

Figs 11-13. Morphometry: Apical axis 14-25.8 µm; Transapical axis 2.6-3.1 µm; Striae 24 in 10 µm.

Figs 14-30. Morphometry: Apical axis 11.1-30.1 µm; Transapical axis 2.5-3.3 µm; Striae 18-25 in 10 µm.

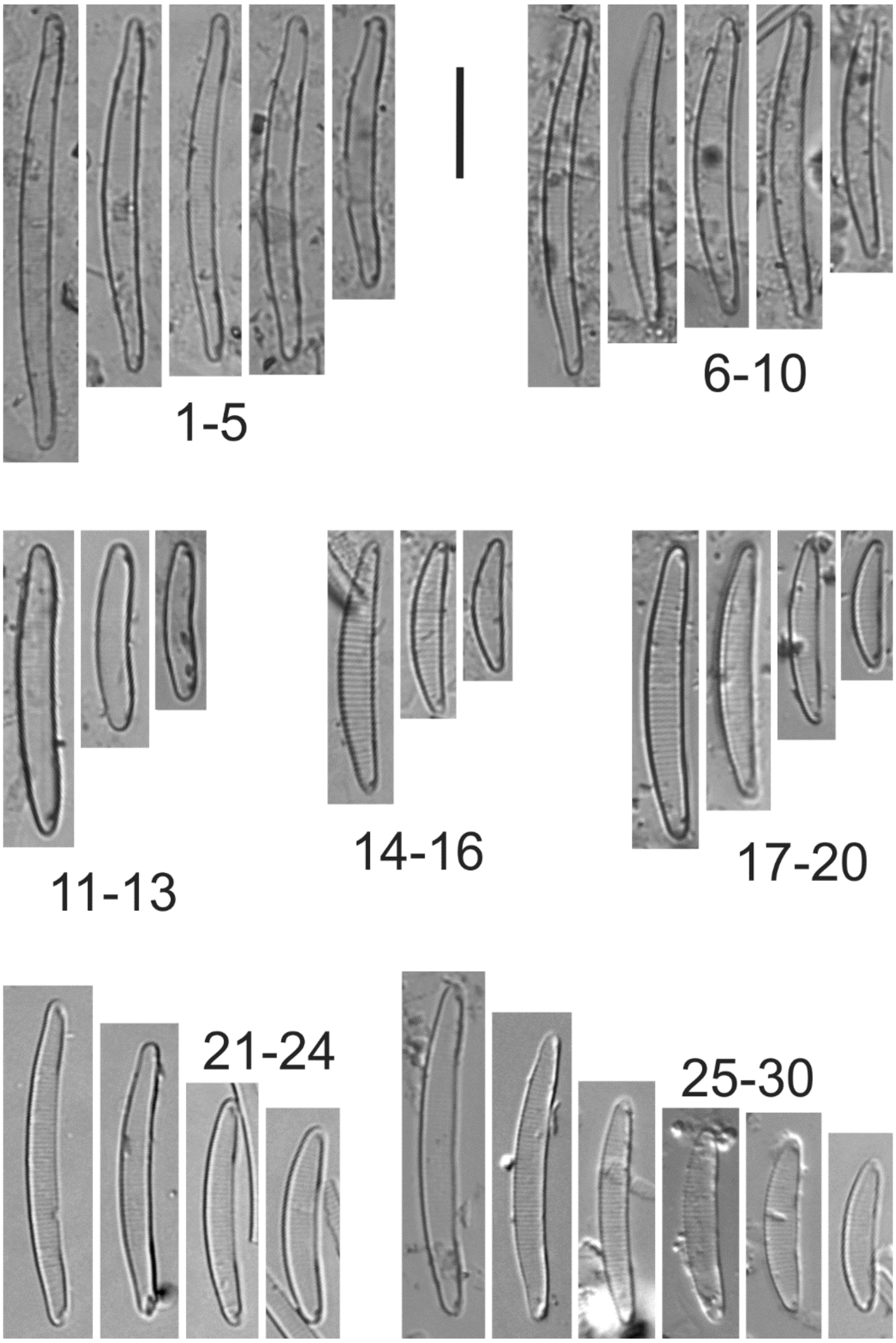

1-5
6-10
11-13
14-16
17-20
21-24
25-30

Plate 18

Scale Bar = 10 µm

Figs 1-4. ***Eunotia valida*** Hustedt

Figs 5-6. ***Eunotia*** sp. 2

Figs 7-8. ***Eunotia fallacoides*** Lange-Bertalot & Cantonati

Figs 9-13. ***Eunotia paulovalida*** Metzeltin & Lange-Bertalot

Figs 1-4. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 5-6. Cachoeira do França reservoir, periphyton. (SP469496)

Figs 7-8. Cachoeira da Fumaça reservoir, surface sediment. (SP469200)

Figs 9-10. Ribeirão do Campo reservoir, periphyton. (SP427982)

Fig. 11. Ribeirão do Campo reservoir, periphyton. (SP427928)

Fig. 12. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Fig. 13. Ribeirão do Campo reservoir, phytoplankton. (SP427921)

Figs 1-4. Morphometry: Apical axis 44.6-73.1 µm; Transapical axis 3.7-4.5 µm; Striae 14-18 in 10 µm.

Figs 5-6. Morphometry: Apical axis 28.9-30.5 µm; Transapical axis 3.1-3.7 µm; Striae 16-17 in 10 µm.

Figs 7-8. Morphometry: Apical axis 26-27.9 µm; Transapical axis 3.1-3.3 µm; Striae 17 in 10 µm.

Figs 9-13. Morphometry: Apical axis 40.9-77.9 µm; Transapical axis 4.3-5.1 µm; Striae 12-13 in 10 µm.

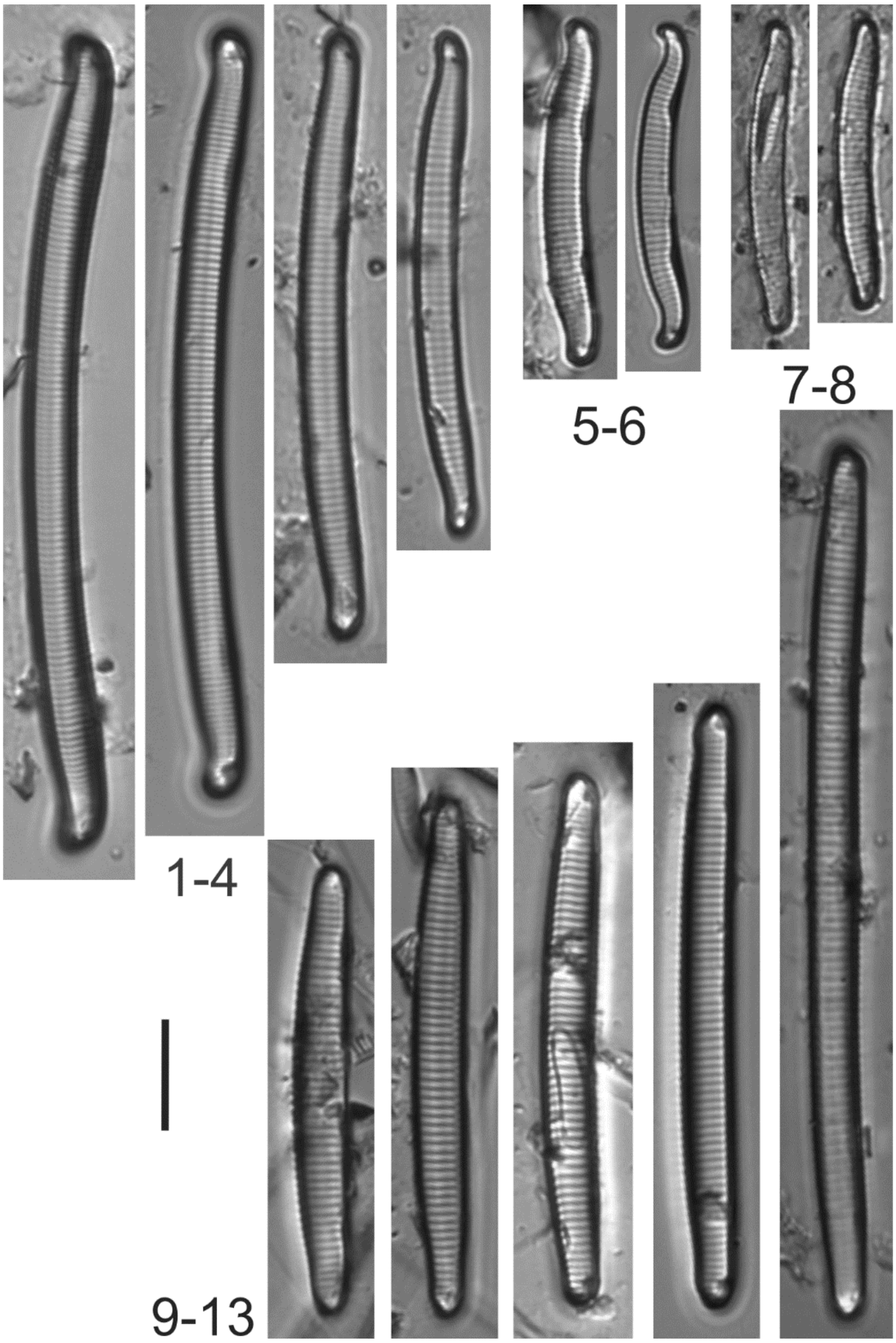

1-4
5-6
7-8
9-13

Plate 19

Scale Bar = 10 µm

Figs 1-22. *Eunotia* sp. nov. 1

Figs 1-9. Pedro Beicht reservoir, phytoplankton. (SP427595)

Figs 10-22. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 1-22. Morphometry: Apical axis 26.7-61.1 µm; Transapical axis 1.8-3 µm; Striae 30-34 in 10 µm.

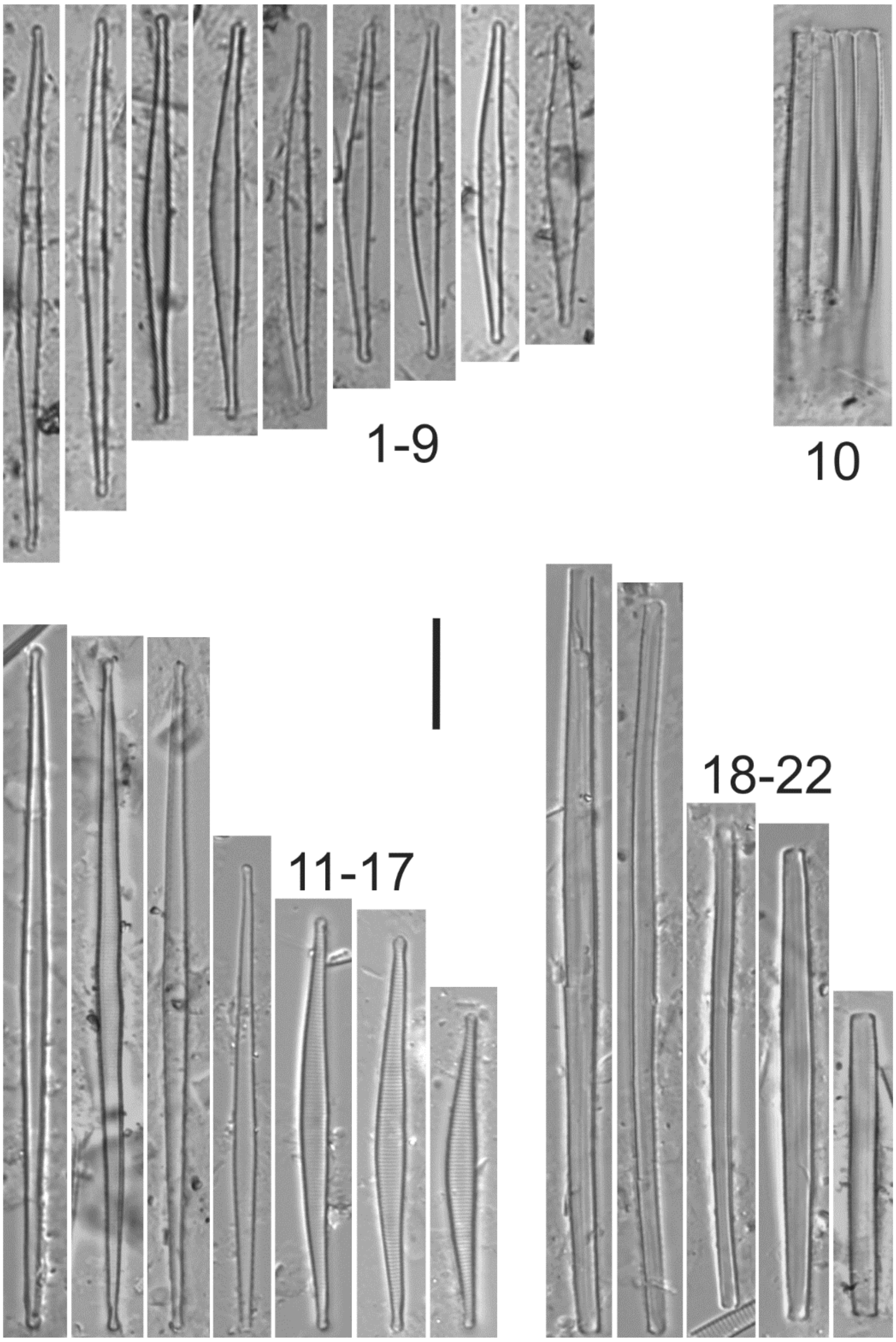

1-9
10
11-17
18-22

Plate 20

Scale Bar = 10 µm: Figs 1, 4; **2 µm**: Figs 2-3, 6; **1 µm**: Fig. 5

Figs 1-6. *Eunotia* sp. nov. 1

Figs 1-6. Pedro Beicht reservoir, phytoplankton. (SP427595)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe and spines.

Fig. 3. External detail of valve view showing central area.

Fig. 4. Frustule in girdle view.

Figs 5-6. External detail of frustule in girdle view.

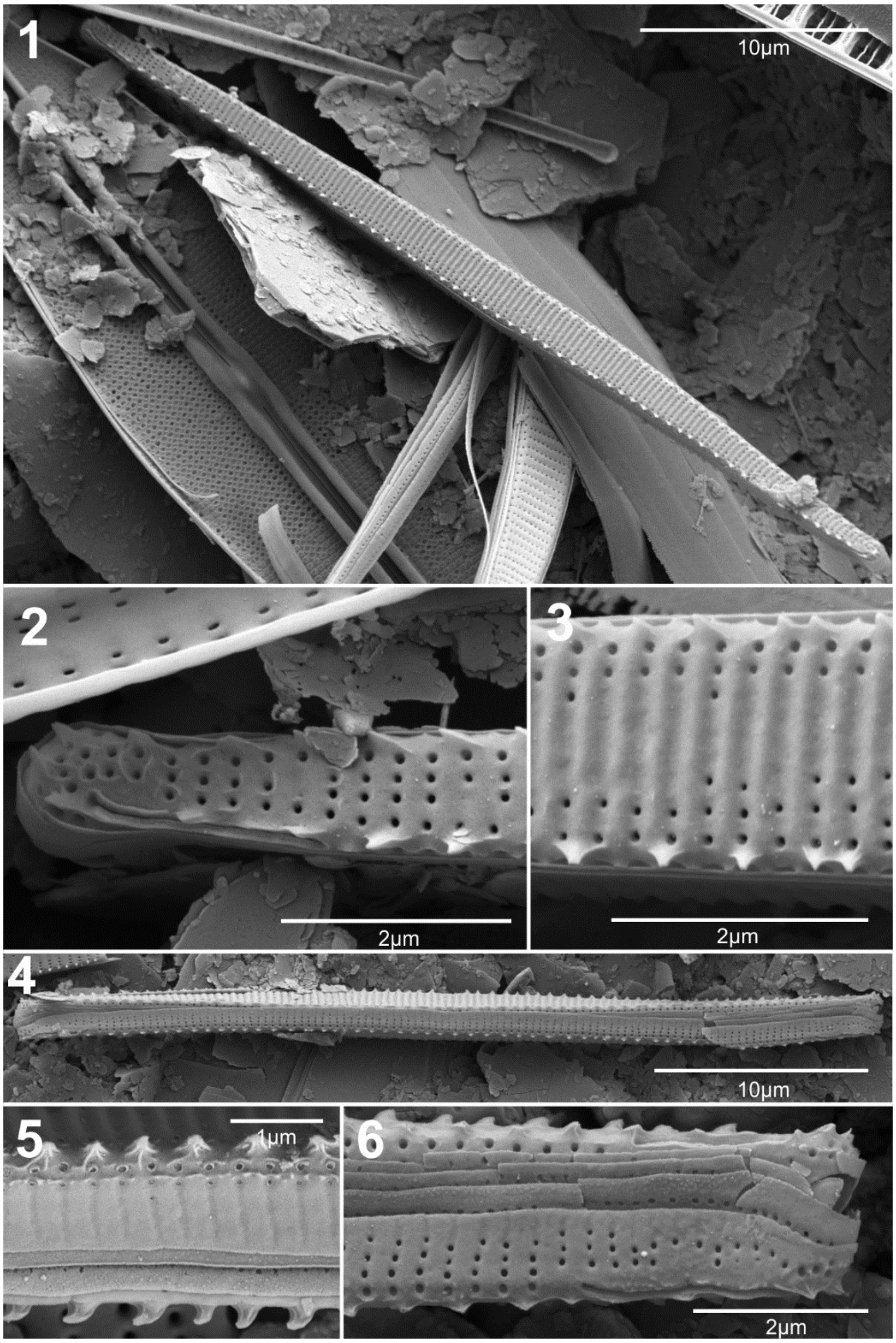

1
10µm
2
2µm
3
2µm
4
10µm
5
1µm
6
2µm

Plate 21

Scale Bar = 10 µm: Fig. 1; **1 µm**: Figs 2-5

Figs 1-5. *Eunotia* sp. nov. 1

Figs 1-5. Pedro Beicht reservoir, surface sediment. (SP427581)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe and spines.

Figs 3-5. Internal details of valves view showing central area, rimoportula and helictoglossae.

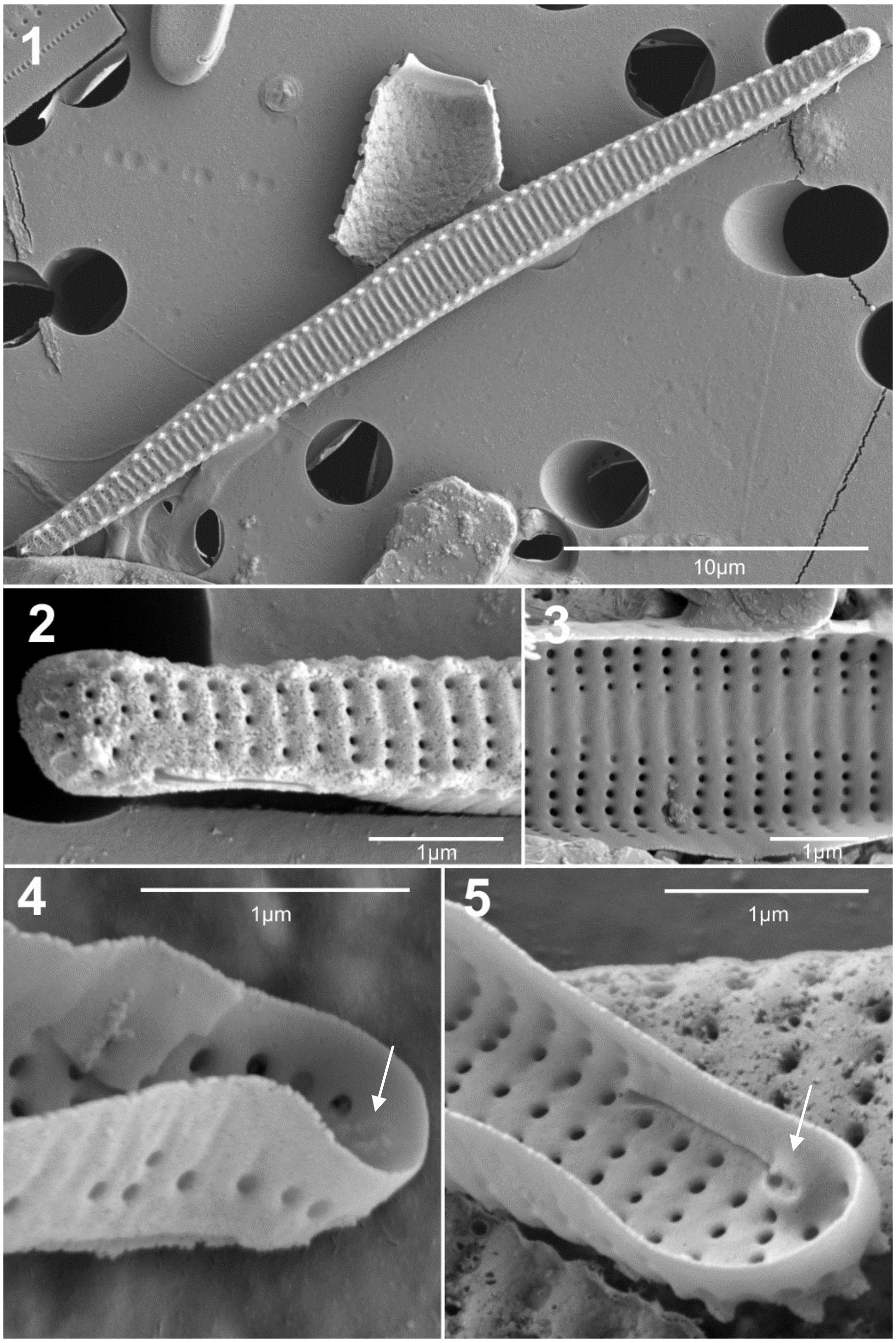

1
10µm
2
1µm
3
1µm
4
1µm
5
1µm

Plate 22

Scale Bar = 10 µm

Figs 1-21. *Eunotia incisa* Gregory

Figs 1-7. Billings reservoir, periphyton. (SP427909)

Figs 8-10. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 11-13. Salto do Iporanga reservoir, phytoplankton. (SP469440)

Figs 14-21. Billings reservoir, phytoplankton. (SP401562)

Figs 1-21. Morphometry: Apical axis 17.9-42.7 µm; Transapical axis 3.2-4.4 µm; Striae 18-21 in 10 µm.

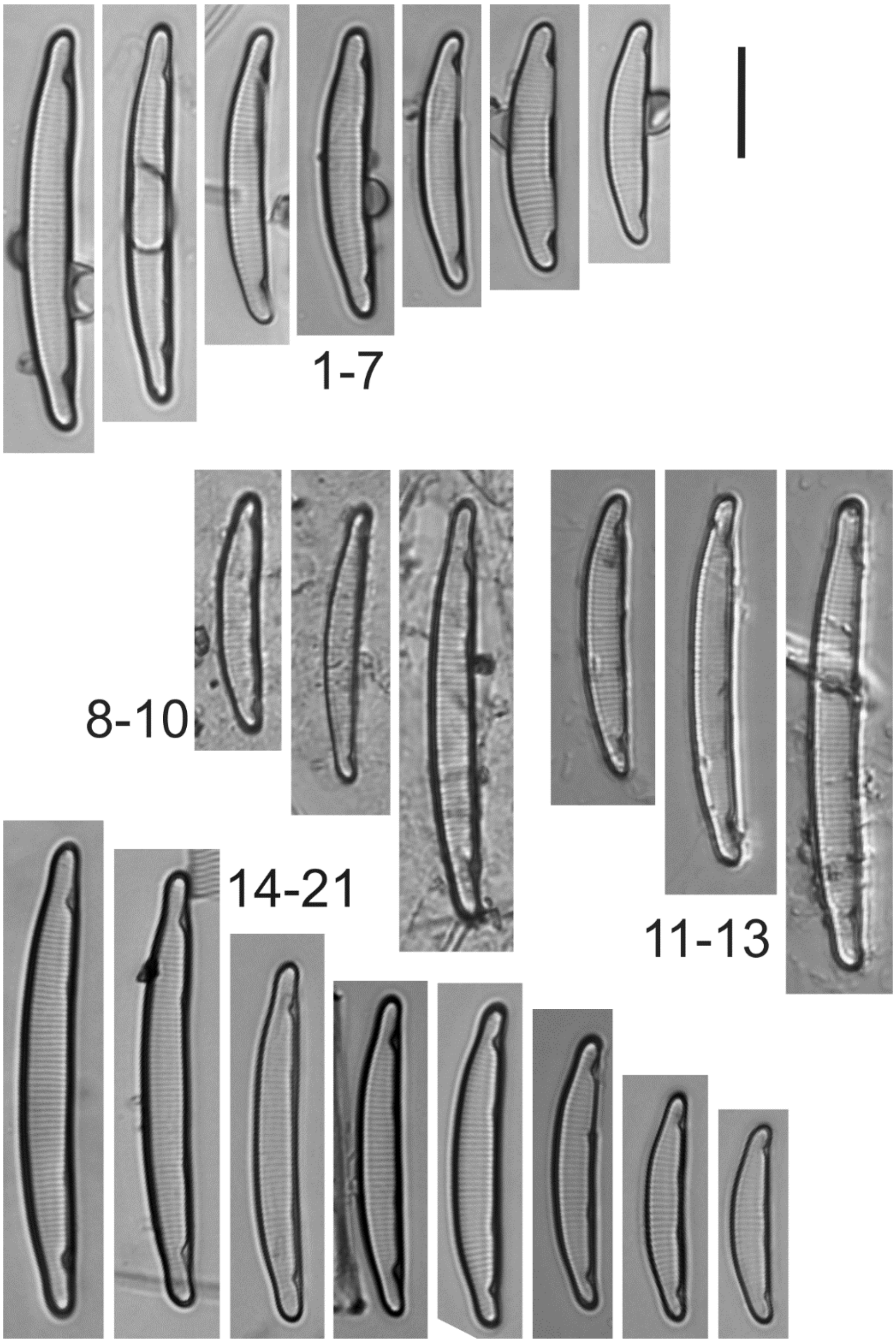

1-7
8-10
11-13
14-21

Plate 23

Scale Bar = 10 µm: Figs 1-2, 5; **5 µm**: Fig. 3; **3 µm**: Fig. 4

Figs 1-5. *Eunotia incisa* Gregory

Figs 1-5. Billings reservoir, periphyton. (SP427909)

Figs 1-2. External valve view.

Fig. 3. External detail of valve view showing raphe and rimoportula.

Fig. 4. Internal detail of valves view showing helictoglossae and rimoportula.

Fig. 5. Frustule in girdle view.

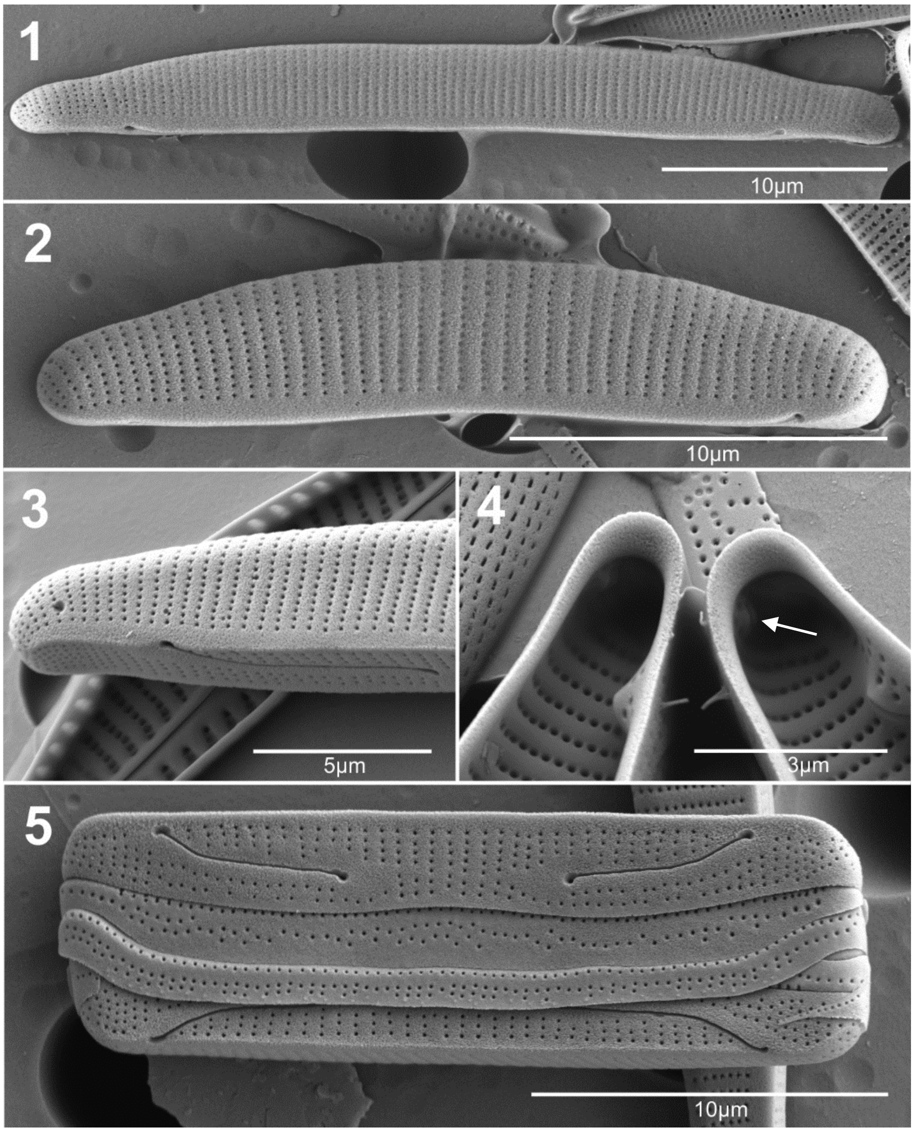

1
10µm
2
10µm
3
5µm
4
3µm
5
10µm

Plate 24

Scale Bar = 10 µm

Figs 1-16. *Eunotia veneris* (Kützing) De Toni

Figs 1-8. Billings reservoir, surface sediment. (SP401589)

Figs 9-16. Ribeirão do Campo reservoir, periphyton. (SP427982)

Figs 1-16. Morphometry: Apical axis 17.8-73.1 µm; Transapical axis 4.5-6.9 µm; Striae 13-19 in 10 µm.

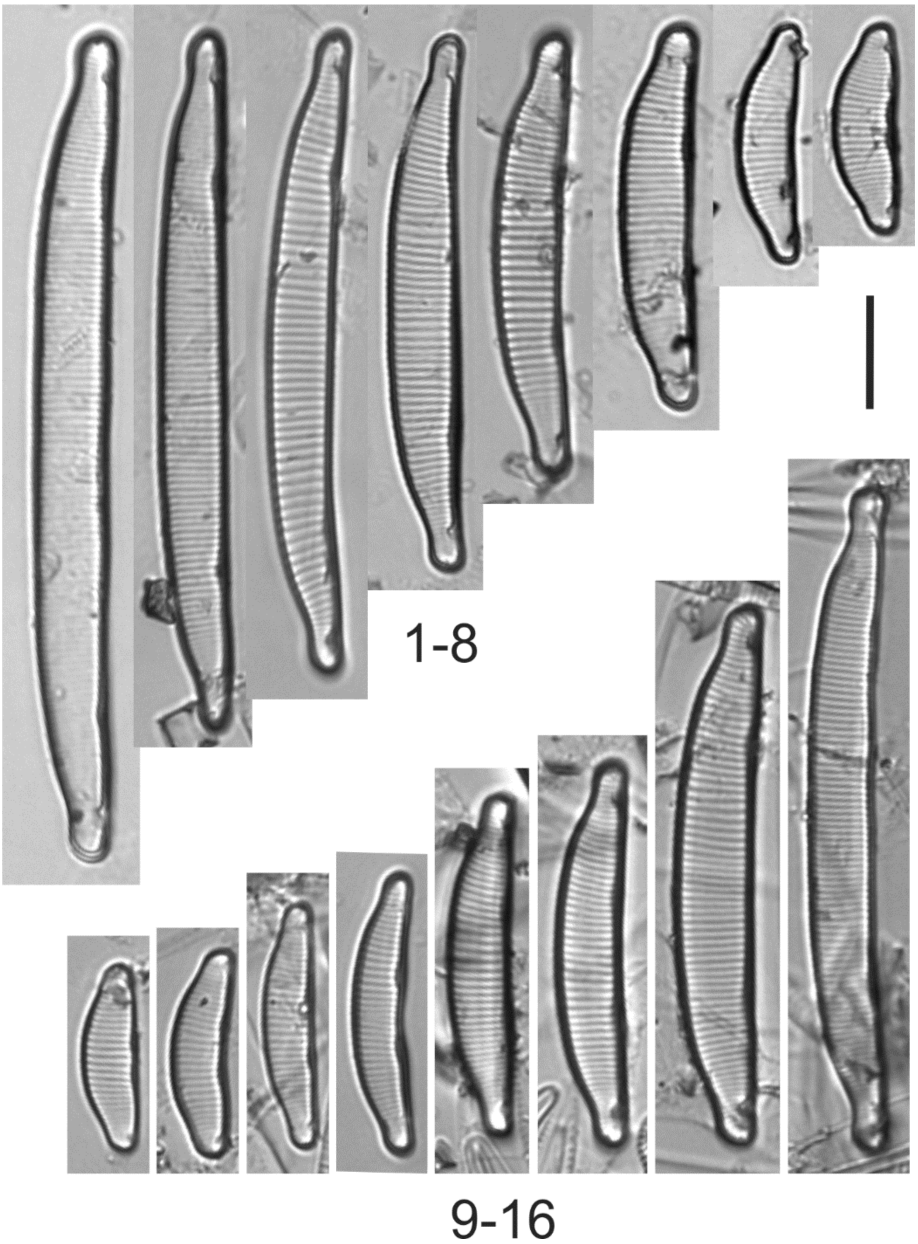

1-8
9-16

Plate 25

Scale Bar = 10 µm

Figs 1-14. *Eunotia veneris* (Kützing) De Toni

Figs 15-17. *Eunotia sudetica* O. Müller

Figs 18-24. *Eunotia* sp. 3

Figs 1-5. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 6-10. Ribeirão do Campo reservoir, surface sediment. (SP468841)

Figs 11-17. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 18-22. Cachoeira da Graça reservoir, surface sediment. (SP427584)

Figs 23-24. Cachoeira do França reservoir, surface sediment. (SP469297)

Figs 1-14. Morphometry: Apical axis 15.3-36.5 µm; Transapical axis 4.8-7.2 µm; Striae 14-19 in 10 µm.

Figs 15-17. Morphometry: Apical axis 15.5-26.8 µm; Transapical axis 7.1-7.9 µm; Striae 12-14 in 10 µm.

Figs 18-24. Morphometry: Apical axis 25-40.1 µm; Transapical axis 6.3-7.9 µm; Striae 11-12 in 10 µm.

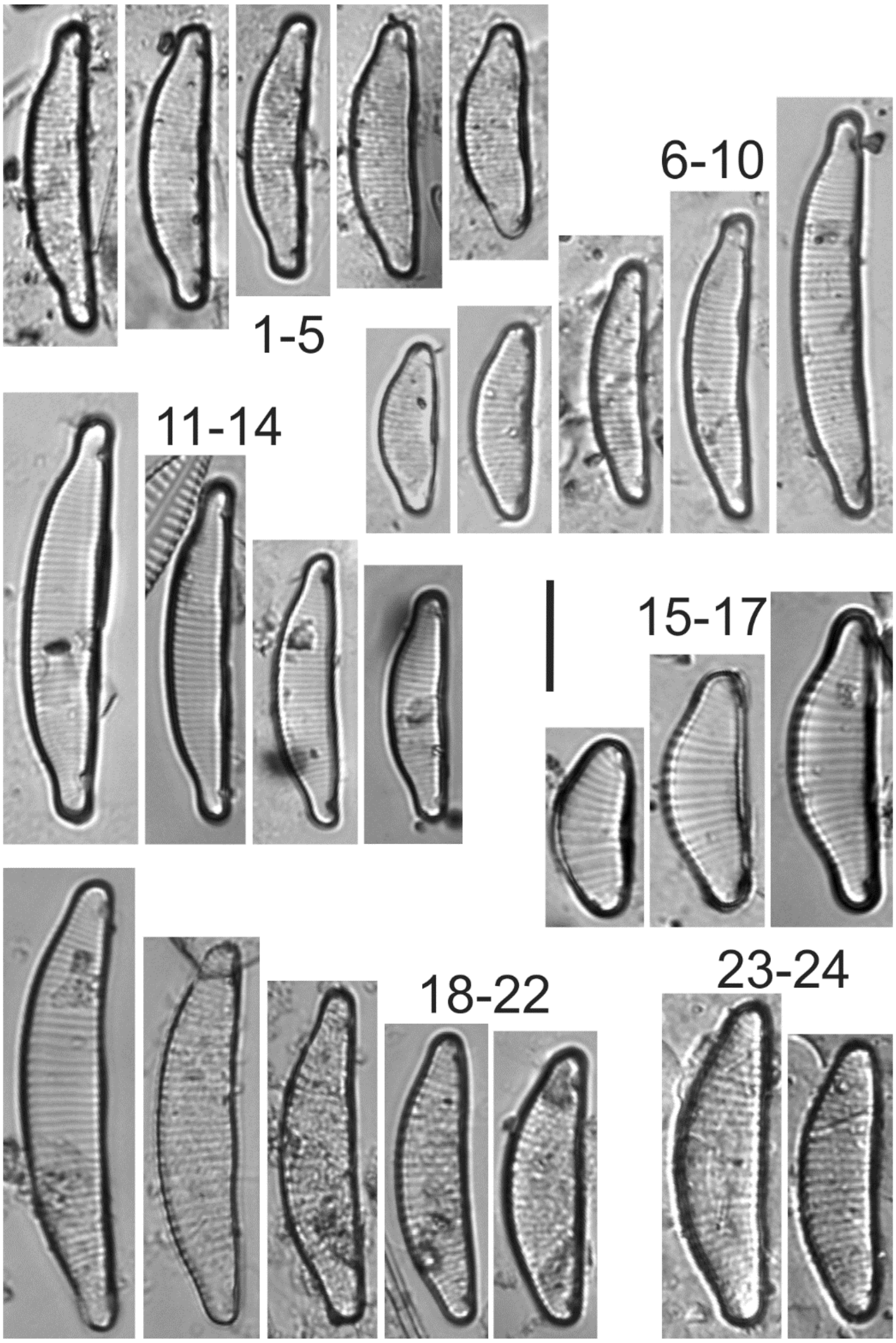

1-5
6-10
11-14
15-17
18-22
23-24

Plate 26

Scale Bar = 10 µm: Figs 1-3; **4 µm**: Fig. 5; **2 µm**: Fig. 4

Figs 1-5. *Eunotia veneris* (Kützing) De Toni

Fig. 1. Billings reservoir, periphyton. (SP427909)

Figs 2-5. Billings reservoir, surface sediment. (SP401589)

Fig. 1. External valve view.

Figs 2-3. Frustule in girdle view.

Fig. 4. External detail of valve view showing rimoportula.

Fig. 5. Internal detail of valve view showing helictoglossae and rimoportula.

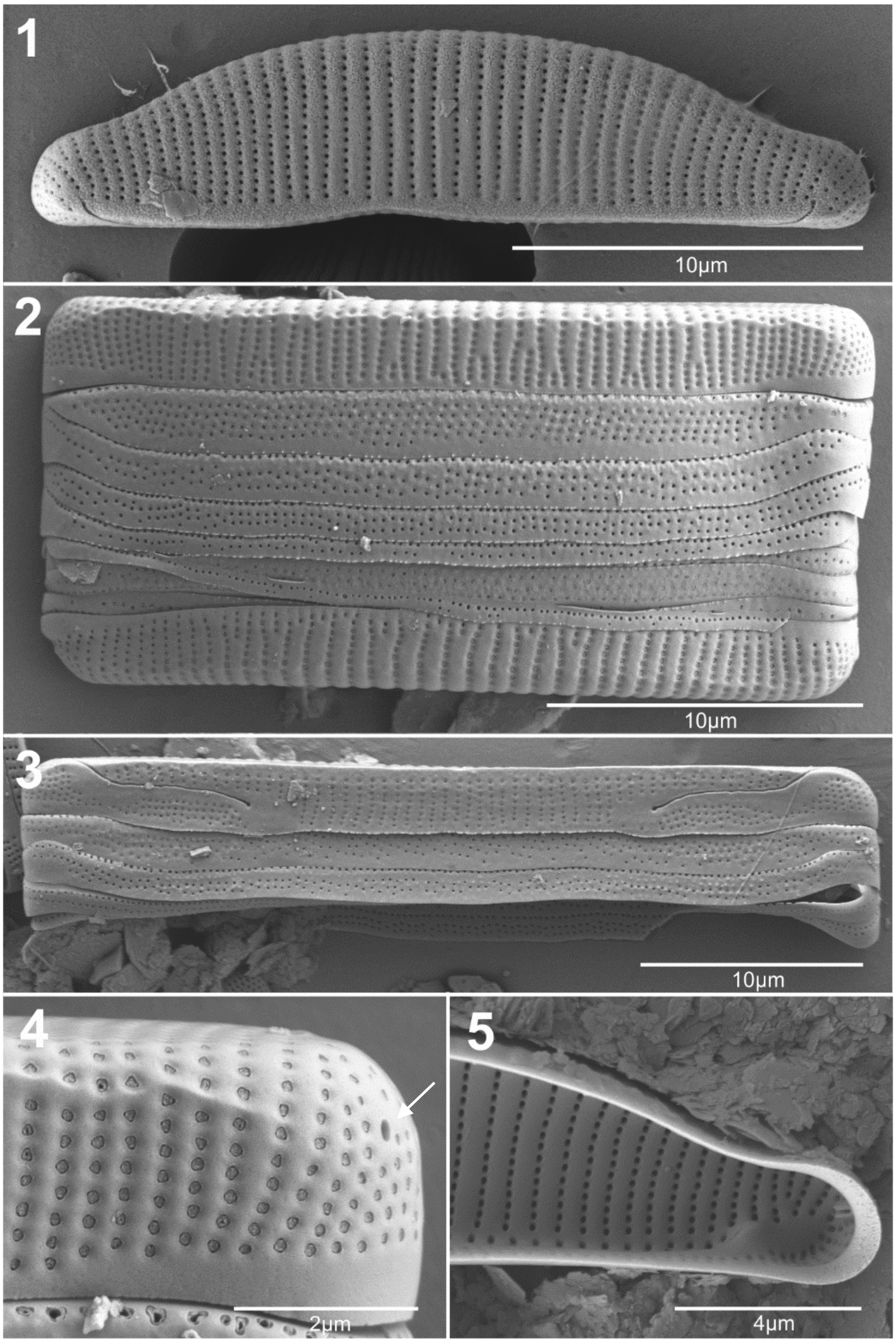

1
10µm
2
10µm
3
10µm
4
2µm
5
4µm

Plate 27

Scale Bar = 10 µm

Figs 1-7. *Eunotia implicata* Nörpel, Alles & Lange-Bertalot

Figs 8-13. *Eunotia* sp. 4

Figs 14-16. *Eunotia parasiolii* Metzeltin & Lange-Bertalot

Figs 17-27. *Eunotia* sp. 5

Figs 1-3. Cabuçu reservoir, periphyton. (SP428942)

Figs 4-7. Cabuçu reservoir, surface sediment. (SP428921)

Figs 8-13. Billings reservoir, surface sediment. (SP401589)

Figs 14-16. Ribeirão do Campo reservoir, phytoplankton. (SP427916)

Figs 17-22. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 23-27. Ipaneminha reservoir, phytoplankton. (SP469507)

Figs 1-7. Morphometry: Apical axis 25.3-38.4 µm; Transapical axis 4.1-5.1 µm; Striae 14-16 in 10 µm.

Figs 8-13. Morphometry: Apical axis 18.2-48.8 µm; Transapical axis 4.5-5.5 µm; Striae 14-17 in 10 µm.

Figs 14-16. Morphometry: Apical axis 13.7-23.9 µm; Transapical axis 2.5-3.9 µm; Striae 11-15 in 10 µm.

Figs 17-27. Morphometry: Apical axis 13.1-29.2 µm; Transapical axis 2.8-3.9 µm; Striae 14-18 in 10 µm.

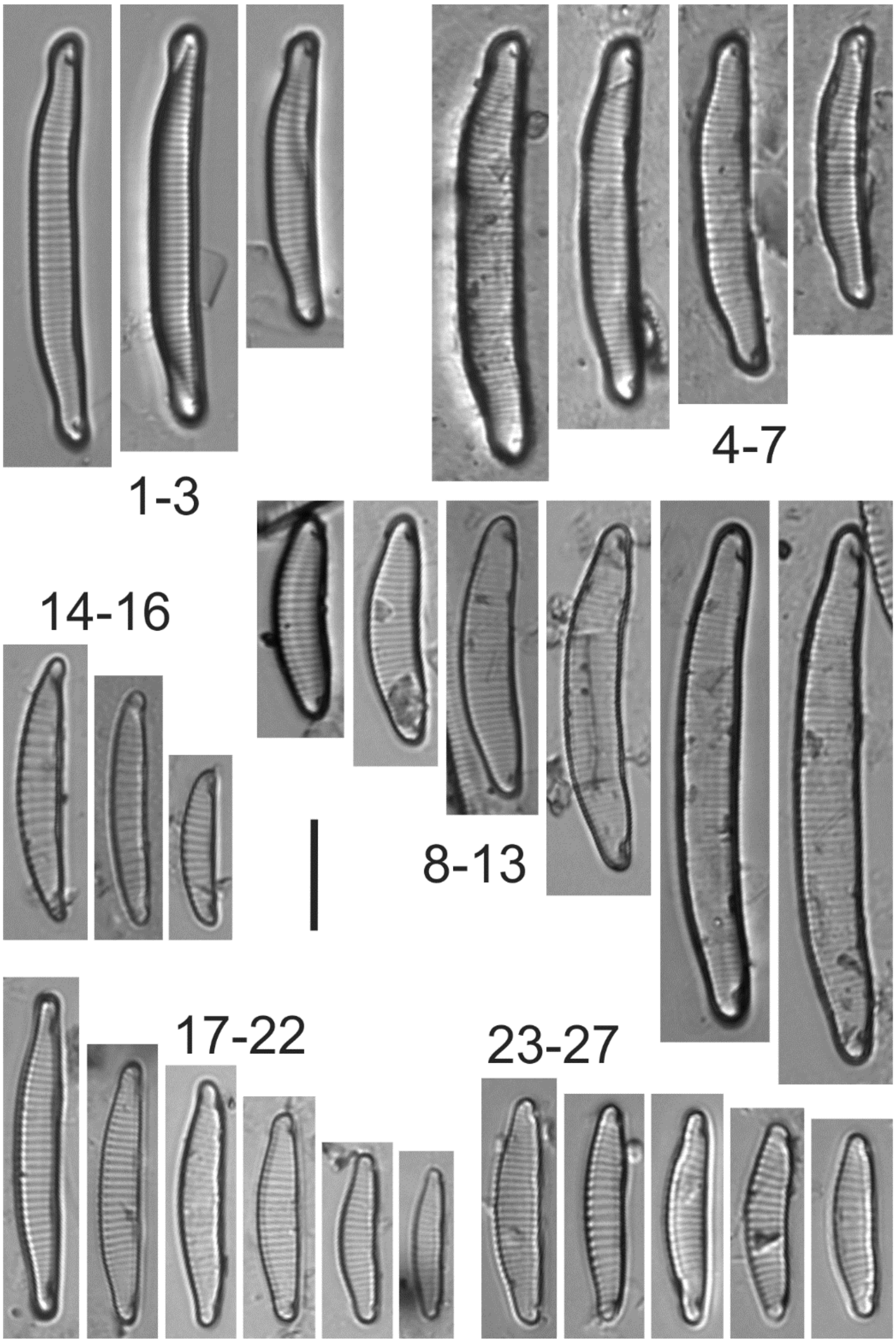

1-3
4-7
14-16
8-13
17-22
23-27

Plate 28

Scale Bar = 20 µm: Fig. 3; **10 µm**: Figs 1-2; **5 µm**: Fig. 4; **4 µm**: Fig. 5

Figs 1-5. *Eunotia implicata* Nörpel, Alles & Lange-Bertalot

Figs 1-2. Cabuçu reservoir, periphyton. (SP428942)

Figs 3-5. Cabuçu reservoir, surface sediment. (SP428921)

Fig. 1. External valve view.

Fig. 2. Frustule in girdle view.

Fig. 3. Internal valve view.

Figs 4-5. Internal detail of valve view showing helictoglossae.

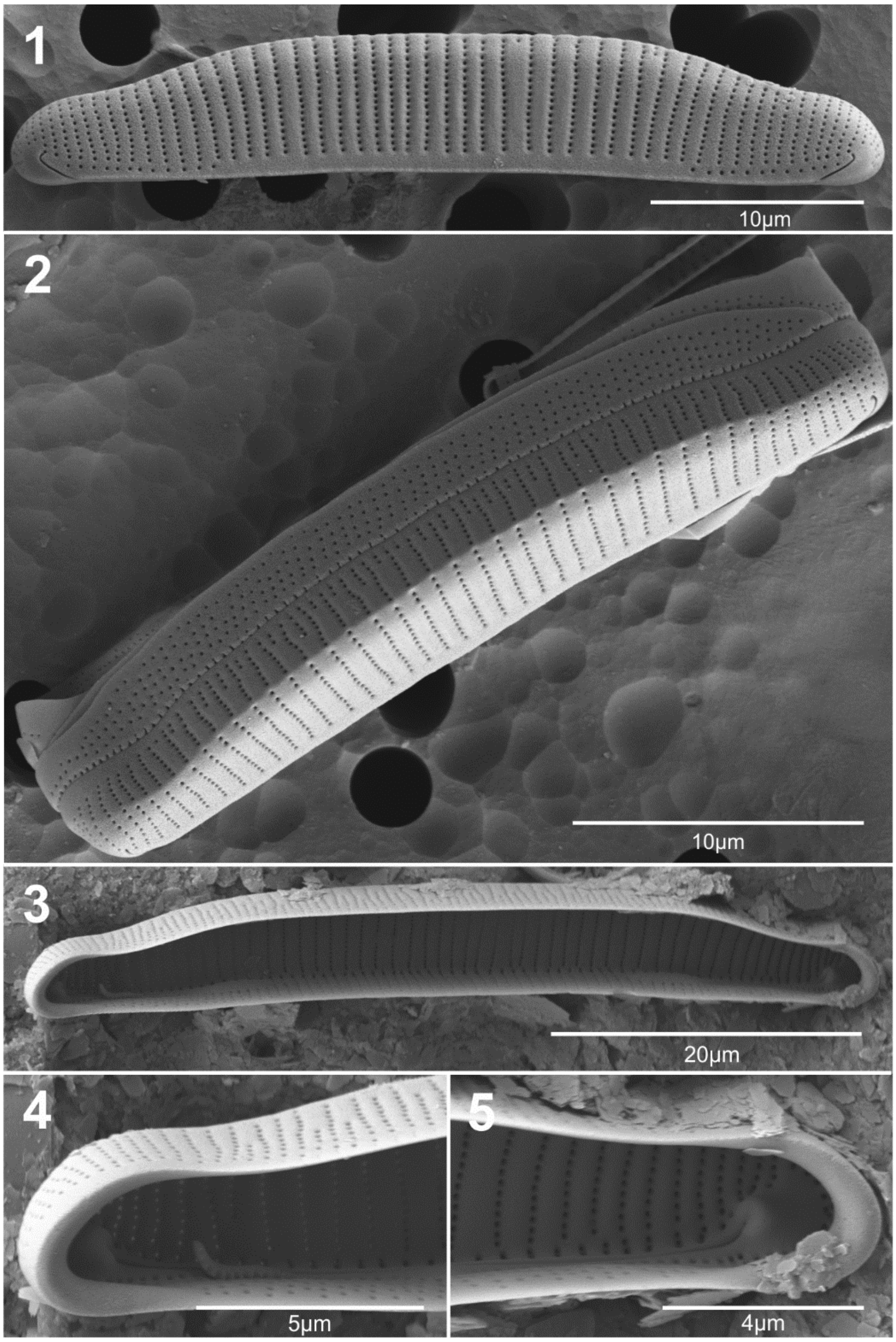

1
10µm
2
10µm
3
20µm
4
5µm
5
4µm

Plate 29

Scale Bar = 10 µm

Figs 1-18. ***Eunotia intricans*** Lange-Bertalot & Metzeltin

Figs 1-8. Prainha de Santa Helena reservoir, periphyton. (SP469525)

Figs 9-13. Paraitinga reservoir, periphyton. (SP427985)

Figs 14-18. Ponte Nova, periphyton. (SP427983)

Figs 1-18. Morphometry: Apical axis 20.5-55.6 µm; Transapical axis 3.5-5.1 µm; Striae 11-16 in 10 µm.

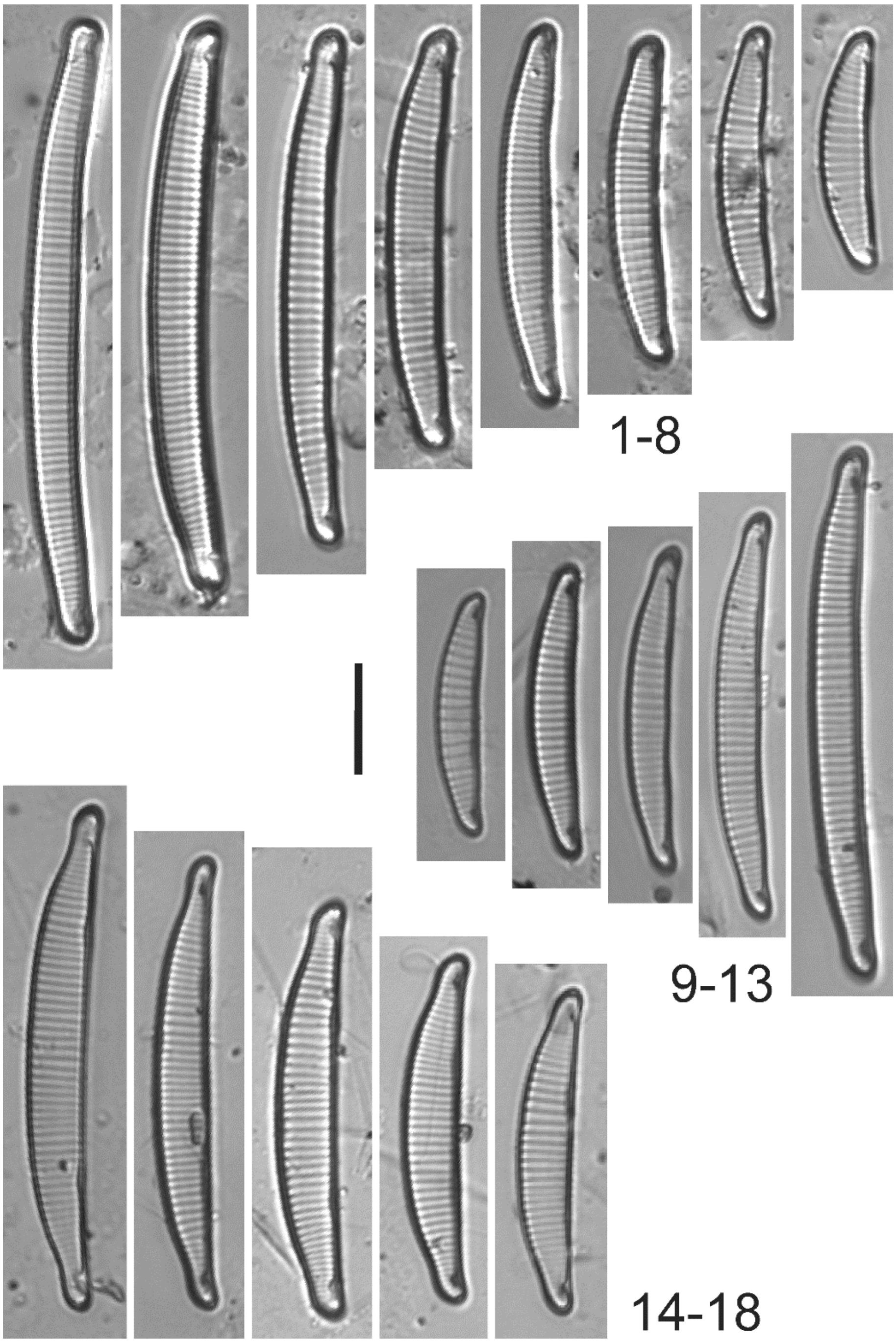

1-8
9-13
14-18

Plate 30

Scale Bar = 10 µm: Figs 1-3, 8; **5 µm**: Fig. 4; **3 µm**: Figs 5-7

Figs 1-8. *Eunotia intricans* Lange-Bertalot & Metzeltin

Figs 1-8. Paraitinga reservoir, periphyton. (SP427985)

Fig. 1. External valve view.

Figs 2-3. Internal valve view.

Fig. 4. External detail of valve view showing raphe.

Fig. 5. Internal detail of valve view showing striae.

Figs 6-7. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 8. Frustule in girdle view.

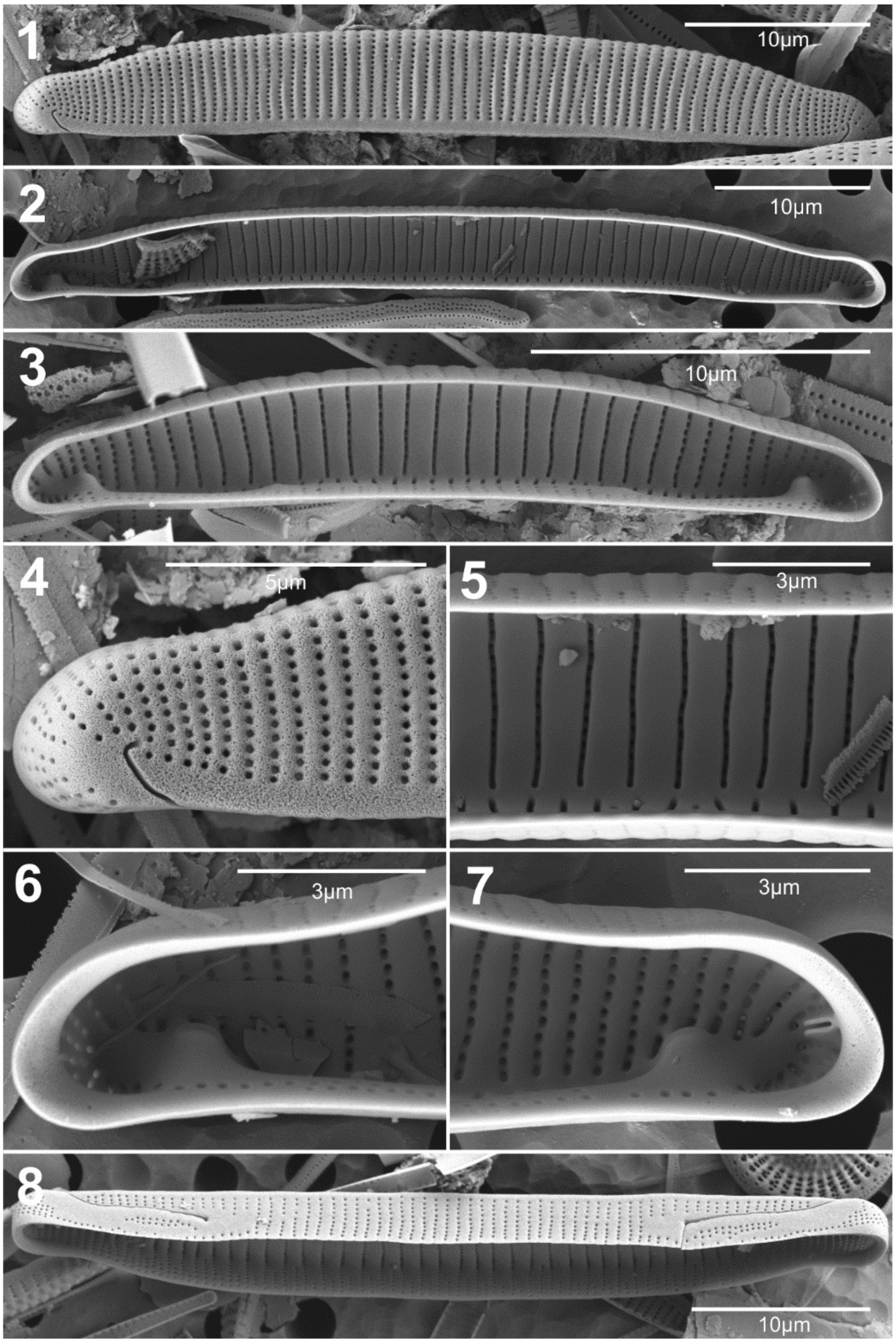

1
10µm
2
10µm
3
10µm
4
5µm
5
3µm
6
3µm
7
3µm
8
10µm

Plate 31

Scale Bar = 10 µm

Figs 1-14. *Eunotia pseudosudetica* Metzeltin, Lange-Bertalot & García-Rodríguez

Figs 1-7. Cabuçu reservoir, surface sediment. (SP428923)

Figs 8-14. Guarapiranga reservoir, surface sediment. (SP428508)

Figs 1-14. Morphometry: Apical axis 22.9-63.8 µm; Transapical axis 4.8-6.7 µm; Striae 10-14 in 10 µm.

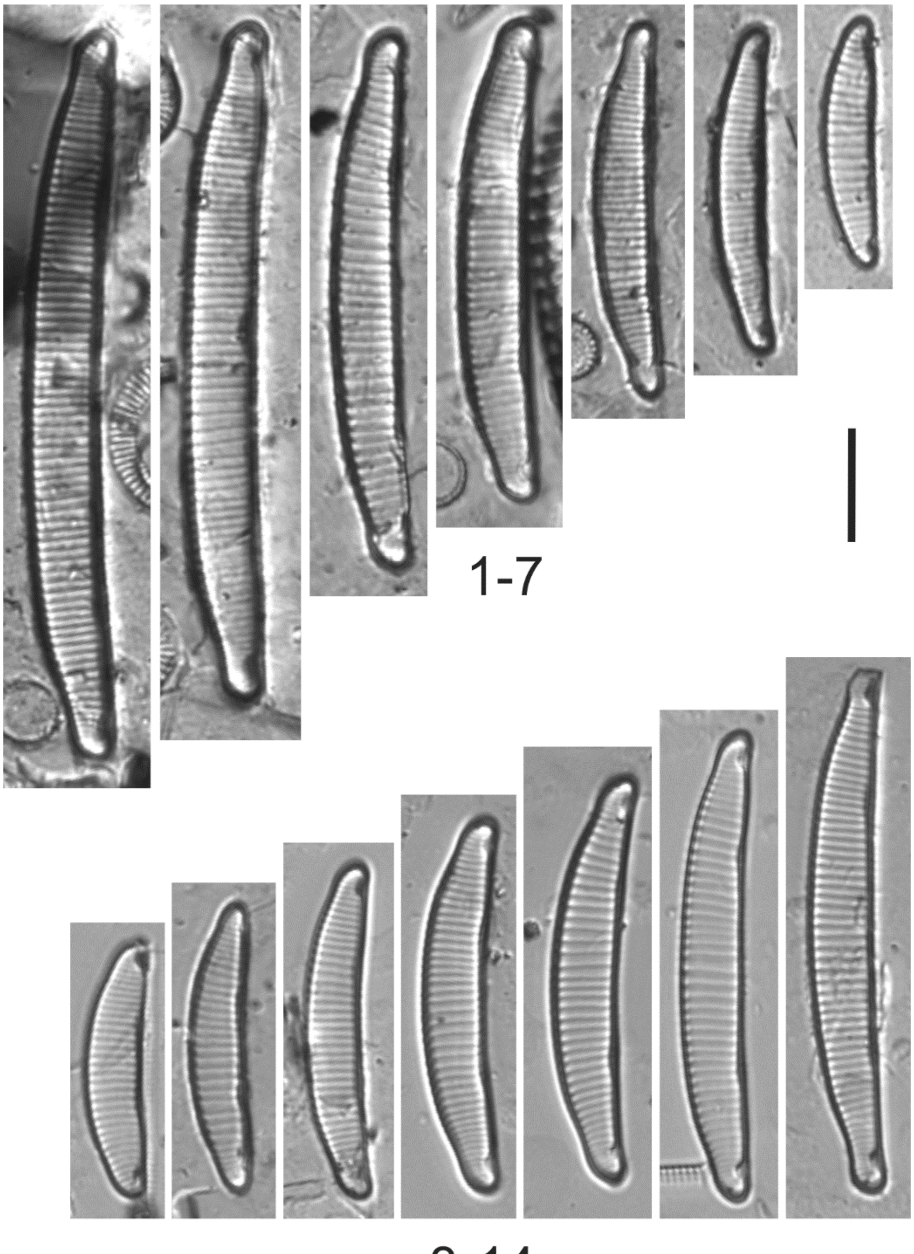

1-7
8-14

Plate 32

Scale Bar = 10 µm

Figs 1-4. ***Eunotia pseudosudetica*** Metzeltin, Lange-Bertalot & García-Rodríguez

Figs 5-14. ***Eunotia meridiana*** Metzeltin & Lange-Bertalot

Figs 15-18. ***Eunotia*** sp. 6

Figs 19-23. ***Eunotia*** sp. 7

Figs 1-4. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 5-7. Tatu reservoir, phytoplankton. (SP469311)

Figs 8-11. Taiaçupeba reservoir, phytoplankton. (SP468833)

Figs 12-14. Salto Grande reservoir, periphyton. (SP469372)

Figs 15-18. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 19-23. Taiaçupeba reservoir, periphyton. (SP427986)

Figs 1-4. Morphometry: Apical axis 37-52.2 µm; Transapical axis 6.3-6.8 µm; Striae 8-12 in 10 µm.

Figs 5-14. Morphometry: Apical axis 18.1-43.7 µm; Transapical axis 4.8-6.3 µm; Striae 10-15 in 10 µm.

Figs 15-18. Morphometry: Apical axis 10.4-17.2 µm; Transapical axis 3.7-4.6 µm; Striae 14-16 in 10 µm.

Figs 19-23. Morphometry: Apical axis 12.4-16.5 µm; Transapical axis 3.3-4 µm; Striae 15-20 in 10 µm.

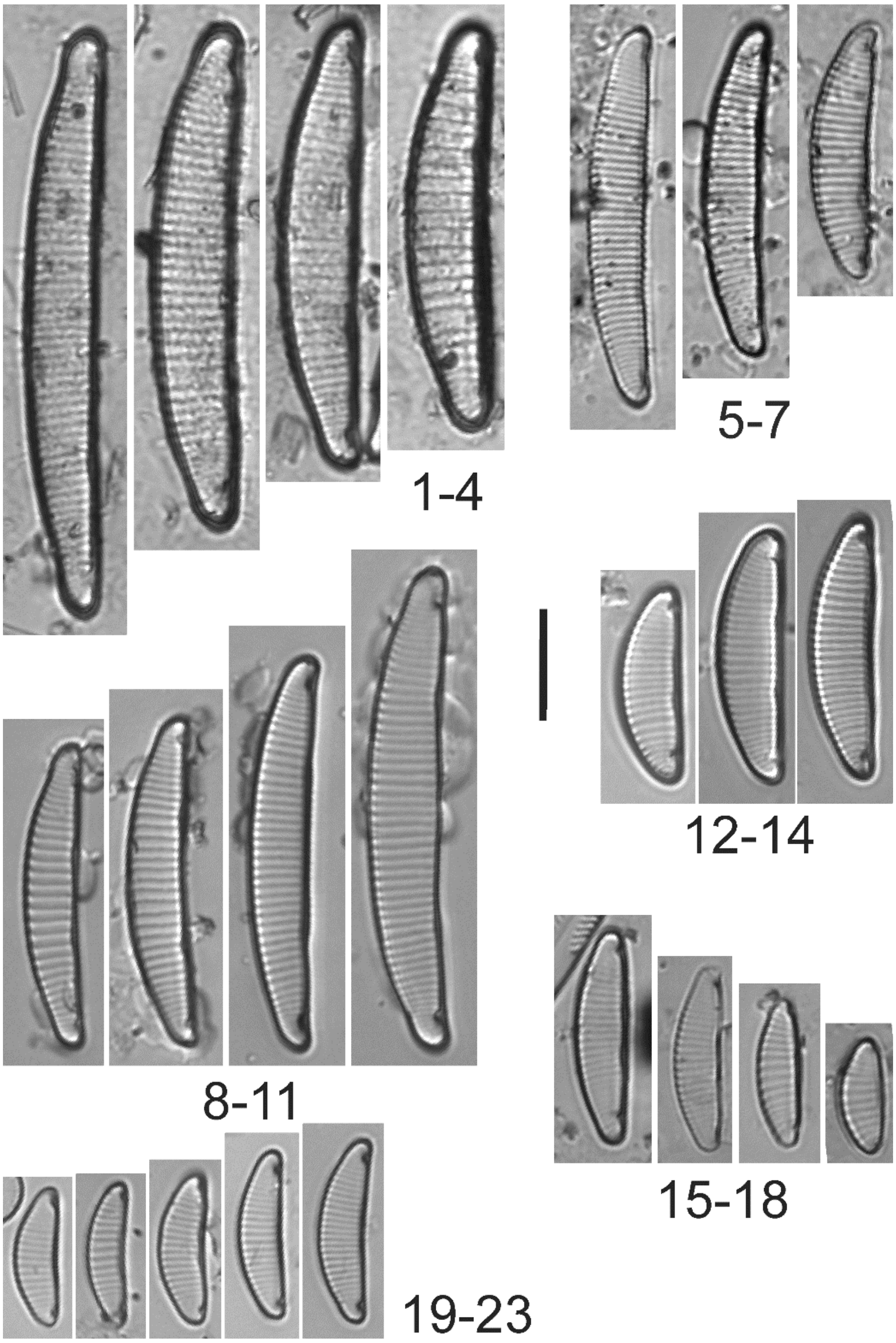

1-4
5-7
8-11
12-14
15-18
19-23

Plate 33

Scale Bar = 20 µm: Fig. 2; **10 µm**: Fig. 1; **4 µm**: Fig. 3

Figs 1-3. *Eunotia pseudosudetica* Metzeltin, Lange-Bertalot & García-Rodríguez

Figs 1-3. Pedro Beicht reservoir, surface sediment. (SP427580)

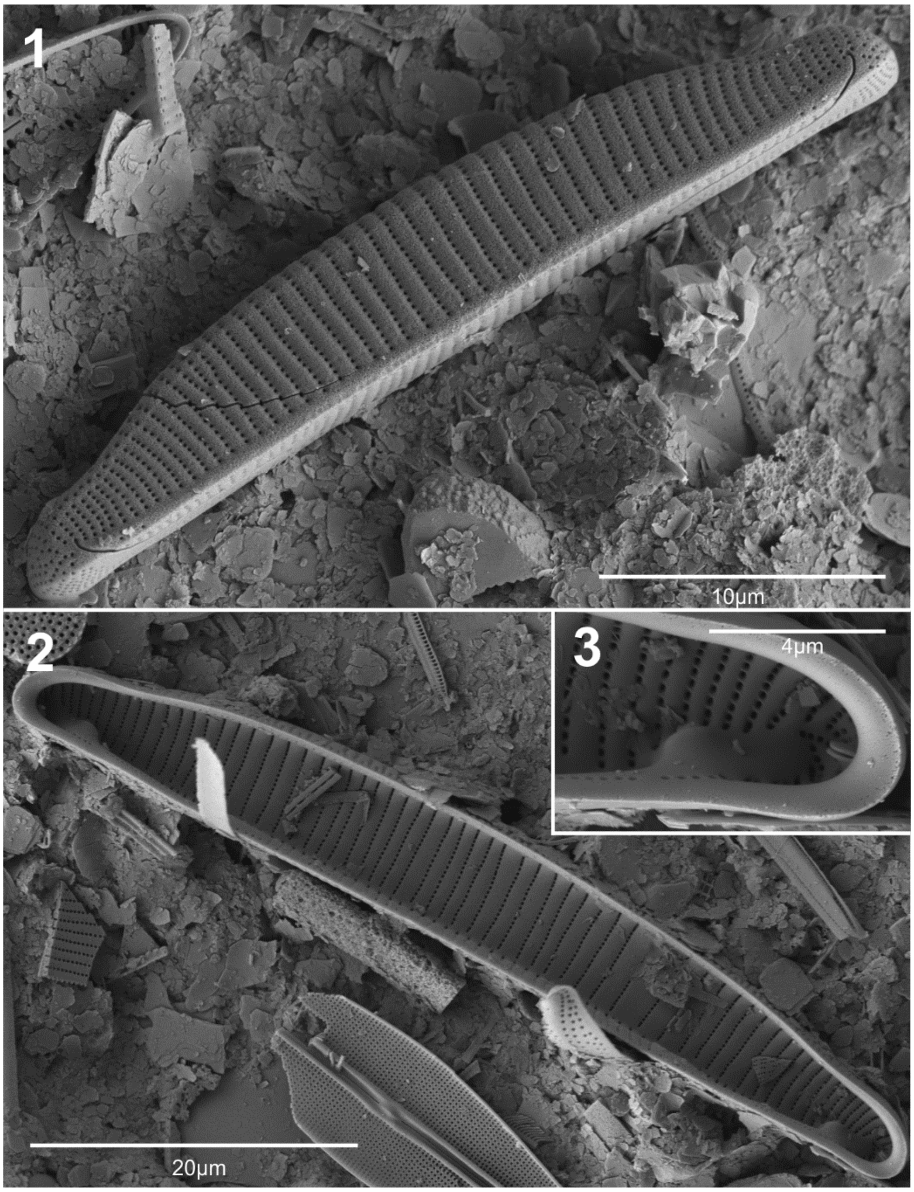

1
10µm
2
20µm
3
4µm

Plate 34

Scale Bar = 10 µm

Figs 1-7. ***Eunotia*** sp. nov. 2

Figs 8-14. ***Eunotia inspectabilis*** Metzeltin & Lange-Bertalot

Figs 1-7. Jundiaí reservoir, periphyton. (SP427989)

Figs 8-14. Rio Negro.

Figs 1-7. Morphometry: Apical axis 34.2-62.2 µm; Transapical axis 4.5-9.9 µm; Striae 12-16 in 10 µm.

Figs 8-14. Morphometry: Apical axis 20.7-58.9 µm; Transapical axis 5.9-10.5 µm; Striae 14-17 in 10 µm.

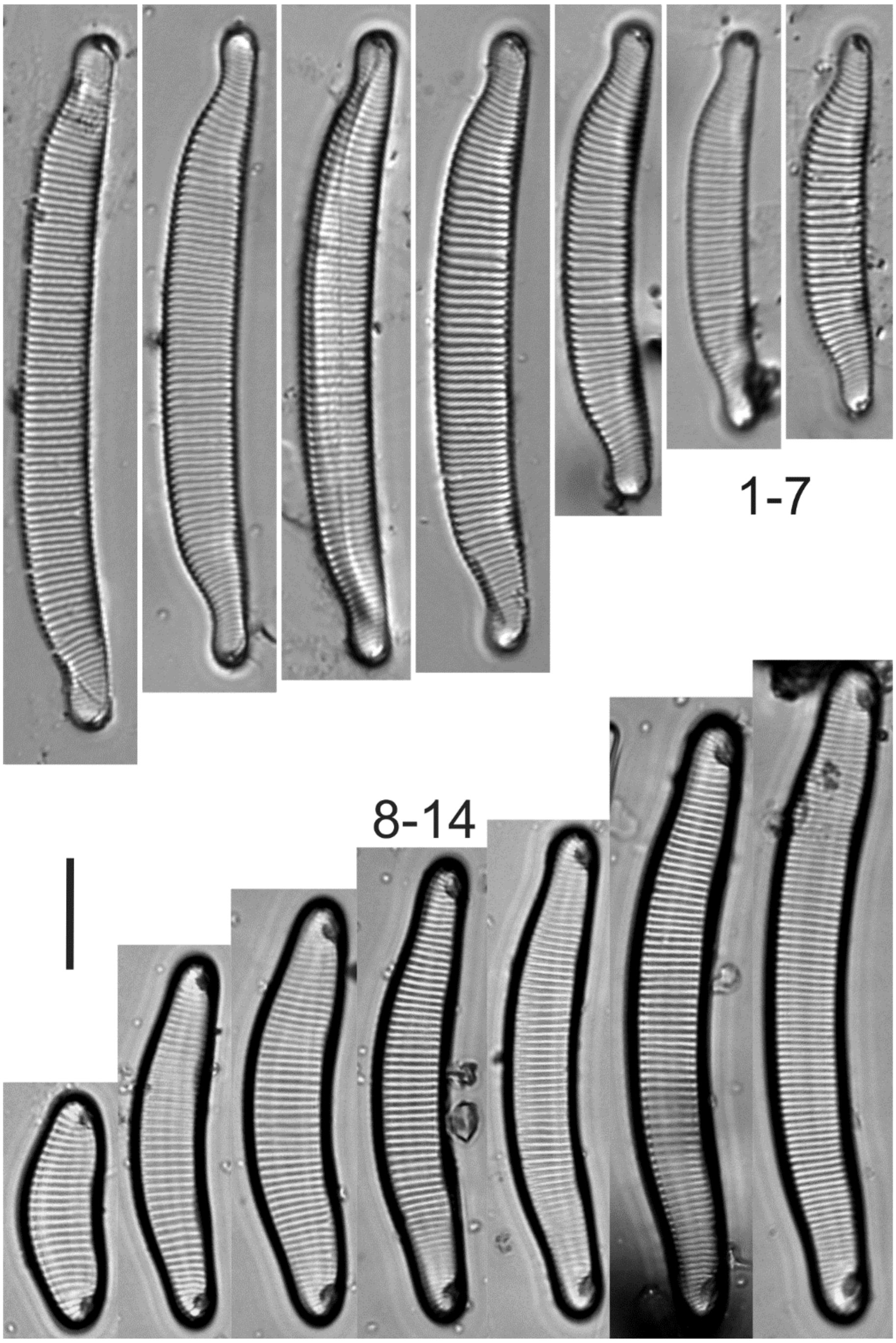

1-7
8-14

Plate 35

Scale Bar = 10 µm

Figs 1-10. ***Eunotia*** sp. nov. 2

Figs 11-16. ***Eunotia*** sp. nov. 3

Figs 1-6. Ponte Nova reservoir, periphyton. (SP427983)

Figs 7-10. Paraitinga reservoir, periphyton. (SP427984)

Figs 11-16. Hedberg reservoir, periphyton. (SP469534)

Figs 1-10. Morphometry: Apical axis 19.9-63 µm; Transapical axis 4.8-11.9 µm; Striae 13-17 in 10 µm.

Figs 11-16. Morphometry: Apical axis 14.4-42 µm; Transapical axis 4.9-7.4 µm; Striae 11-14 in 10 µm.

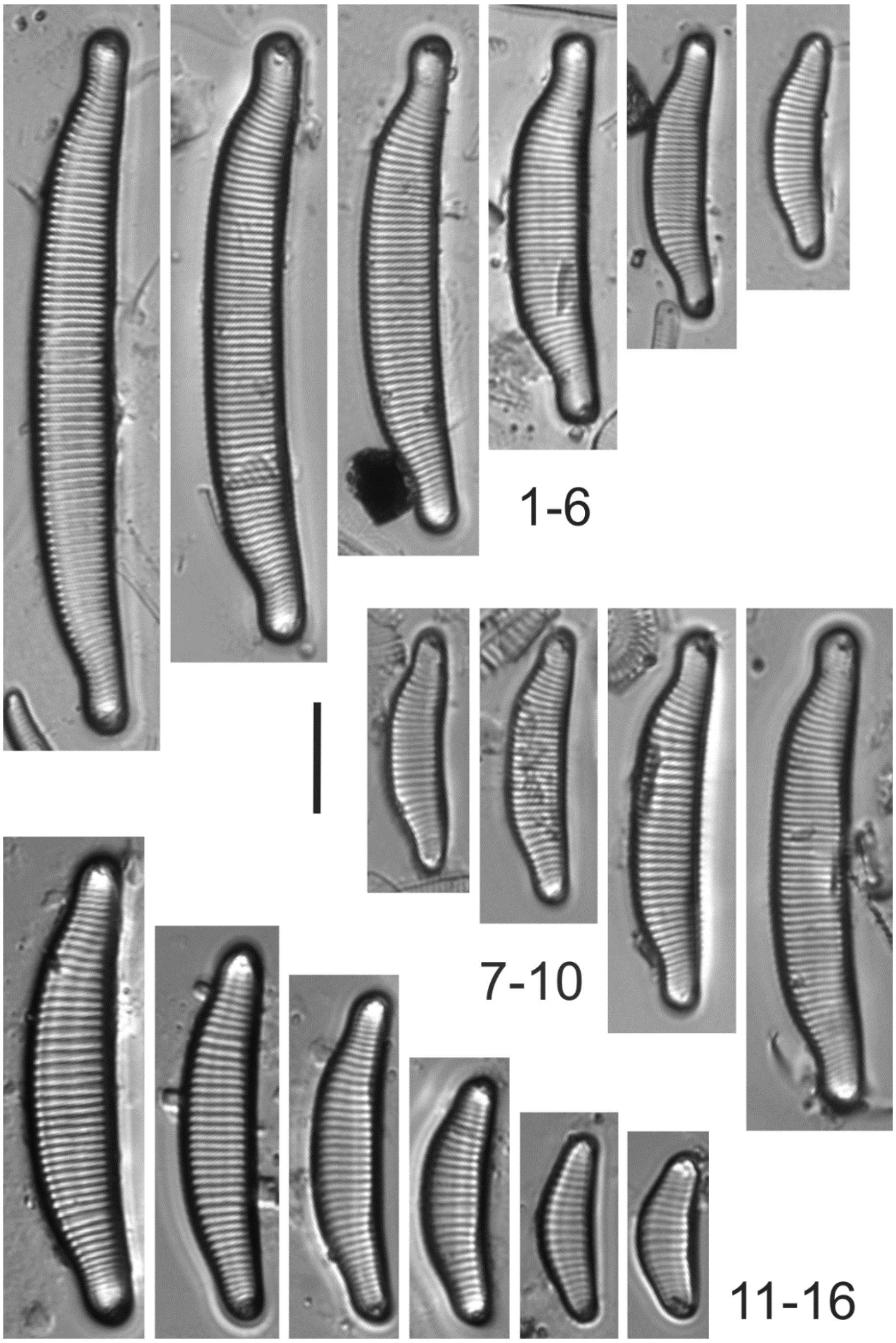

1-6
7-10
11-16

Plate 36

Scale Bar = 20 µm: Fig. 1; **10 µm**: Figs 2, 7; **4 µm**: Figs 3-4; **3 µm**: Figs 5-6

Figs 1-7. ***Eunotia*** sp. nov. 2

Figs 1-7. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-2. External valves view.

Fig. 3. External detail of valve view showing raphe.

Fig. 4. External detail of striae in valve view

Figs 5-6. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 7. Frustule in girdle view.

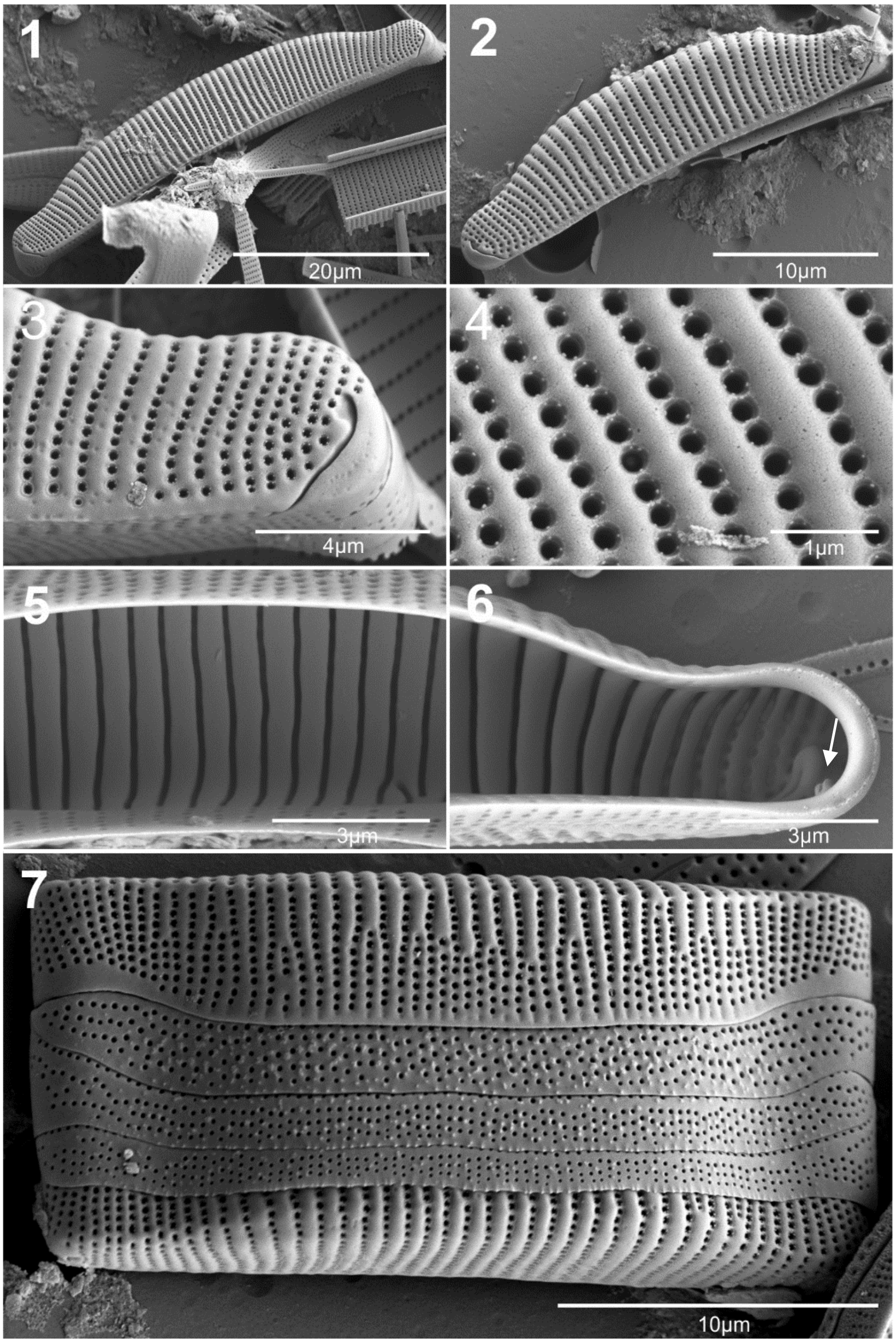

1
2
3
4
5
6
7
20µm
10µm
4µm
1µm
3µm
3µm
10µm

Plate 37

Scale Bar = 30 µm: Figs 5-6; **20 µm**: Fig. 2; **10 µm**: Fig. 1; **5 µm**: Fig. 4; **3 µm**: Fig. 3

Figs 1-6. *Eunotia* sp. nov. 3

Figs 1-6. Hedberg reservoir, periphyton. (SP469534)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. External detail of valve view showing raphe.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 5. External valve view of initial valve.

Fig. 6. Frustule in girdle view.

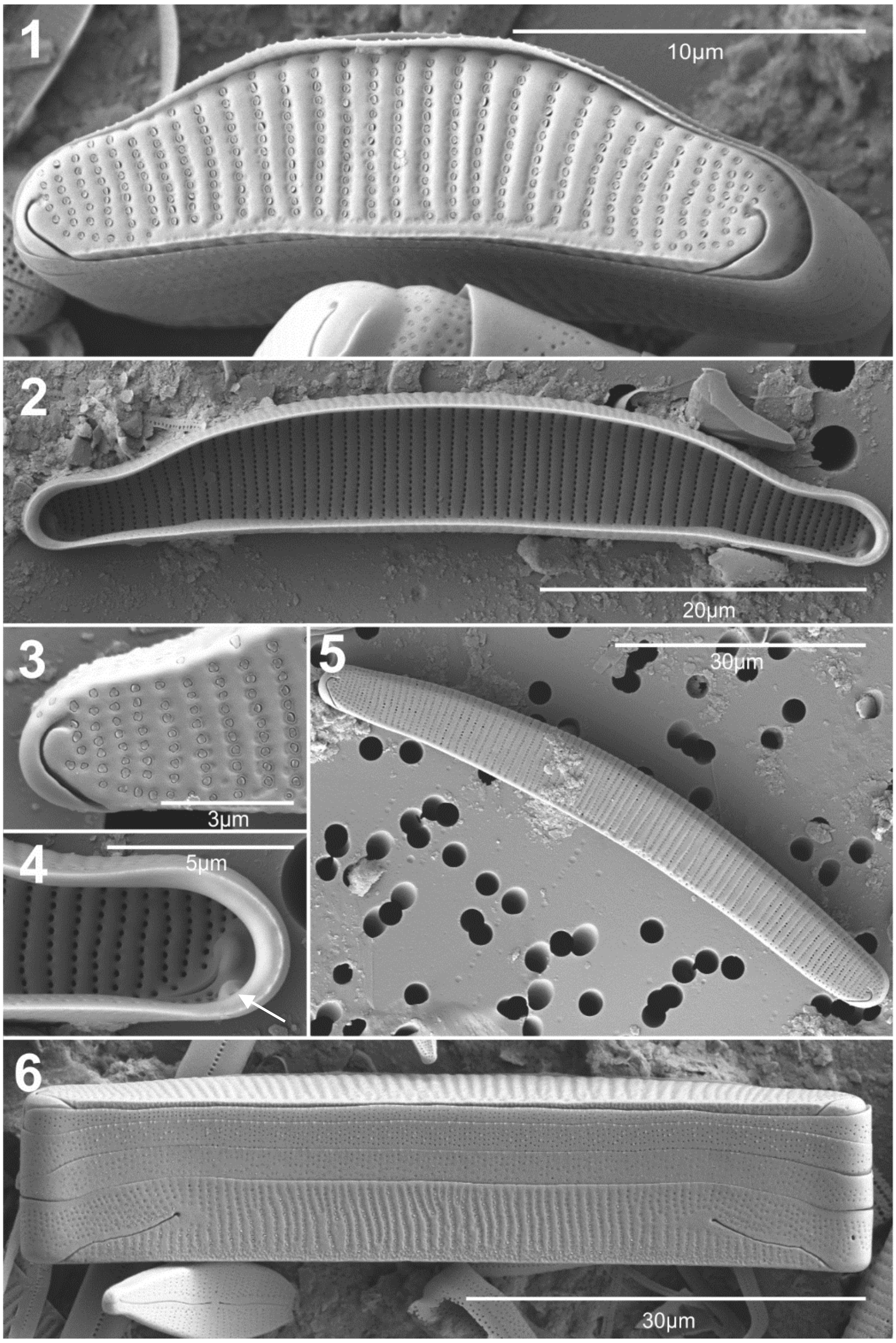

1
10μm
2
20μm
3
3μm
4
5μm
5
30μm
6
30μm

Plate 38

Scale Bar = 10 µm

Figs 1-11. *Eunotia longicollis* Metzeltin & Lange-Bertalot

Figs 1-6. Tatu reservoir, periphyton. (SP469385)

Figs 7-11. Tatu reservoir, periphyton. (SP469376)

Figs 1-11. Morphometry: Apical axis 28.2-72.2 µm; Transapical axis 6.3-7.9 µm; Striae 9-12 in 10 µm.

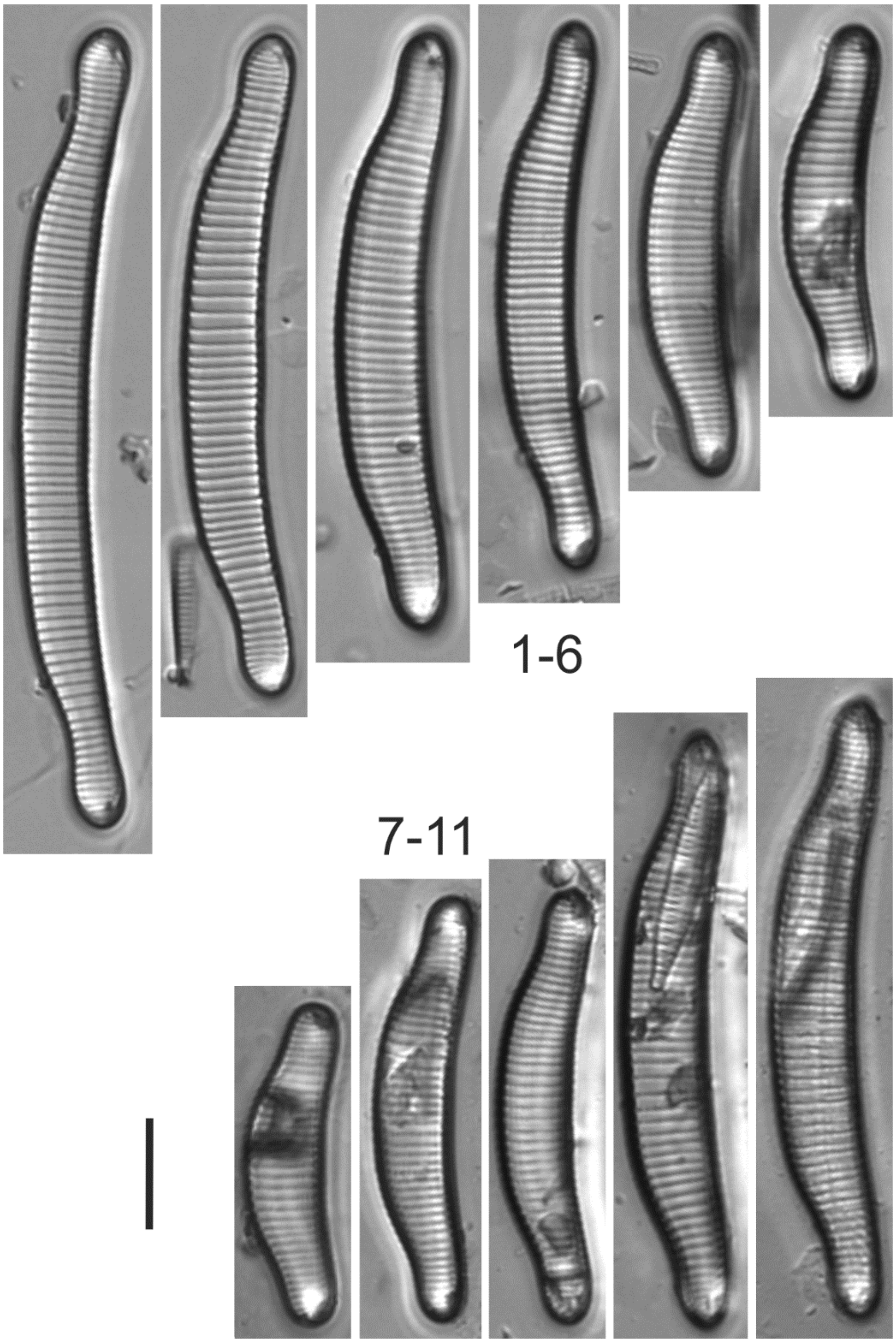

1-6
7-11

Plate 39

Scale Bar = 10 µm

Figs 1-12. *Eunotia* sp. nov. 4

Figs 1-6. Guarapiranga reservoir, phytoplankton. (SP469474)

Figs 7-9. Guarapiranga reservoir, surface sediment. (SP428512)

Figs 10-12. Guarapiranga reservoir, surface sediment. (SP428513)

Figs 1-12. Morphometry: Apical axis 26-62.7 µm; Transapical axis 7.2-8.7 µm; Striae 8-12 in 10 µm.

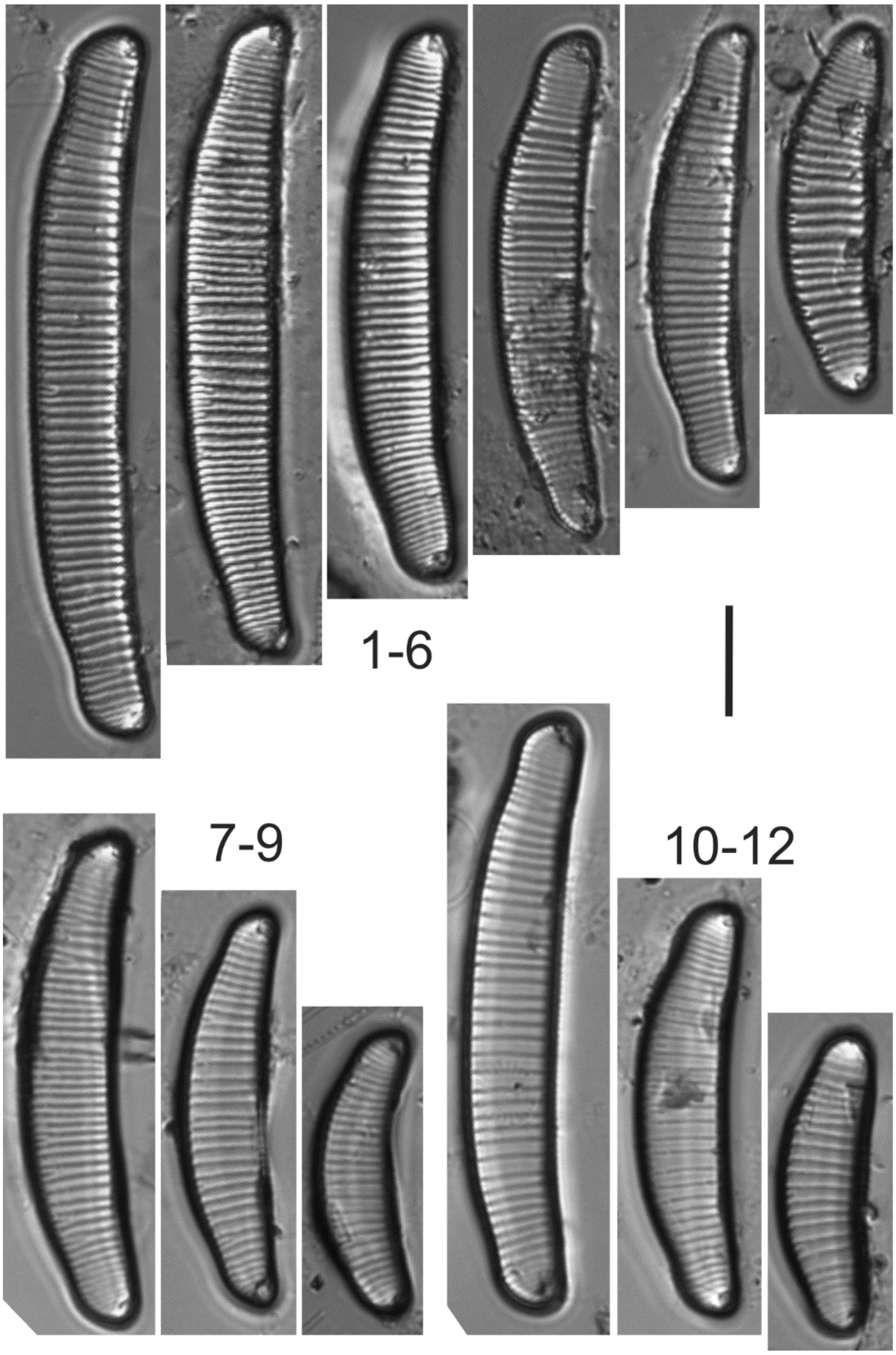

1-6
7-9
10-12

Plate 40

Scale Bar = 20 µm: Figs 1, 5; **5 µm**: Figs 2-4

Figs 1-5. ***Eunotia*** sp. nov. 4

Figs 1-5. Guarapiranga reservoir, surface sediment. (SP428512)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe.

Fig. 3. External detail of central area.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 5. Valve in girdle view.

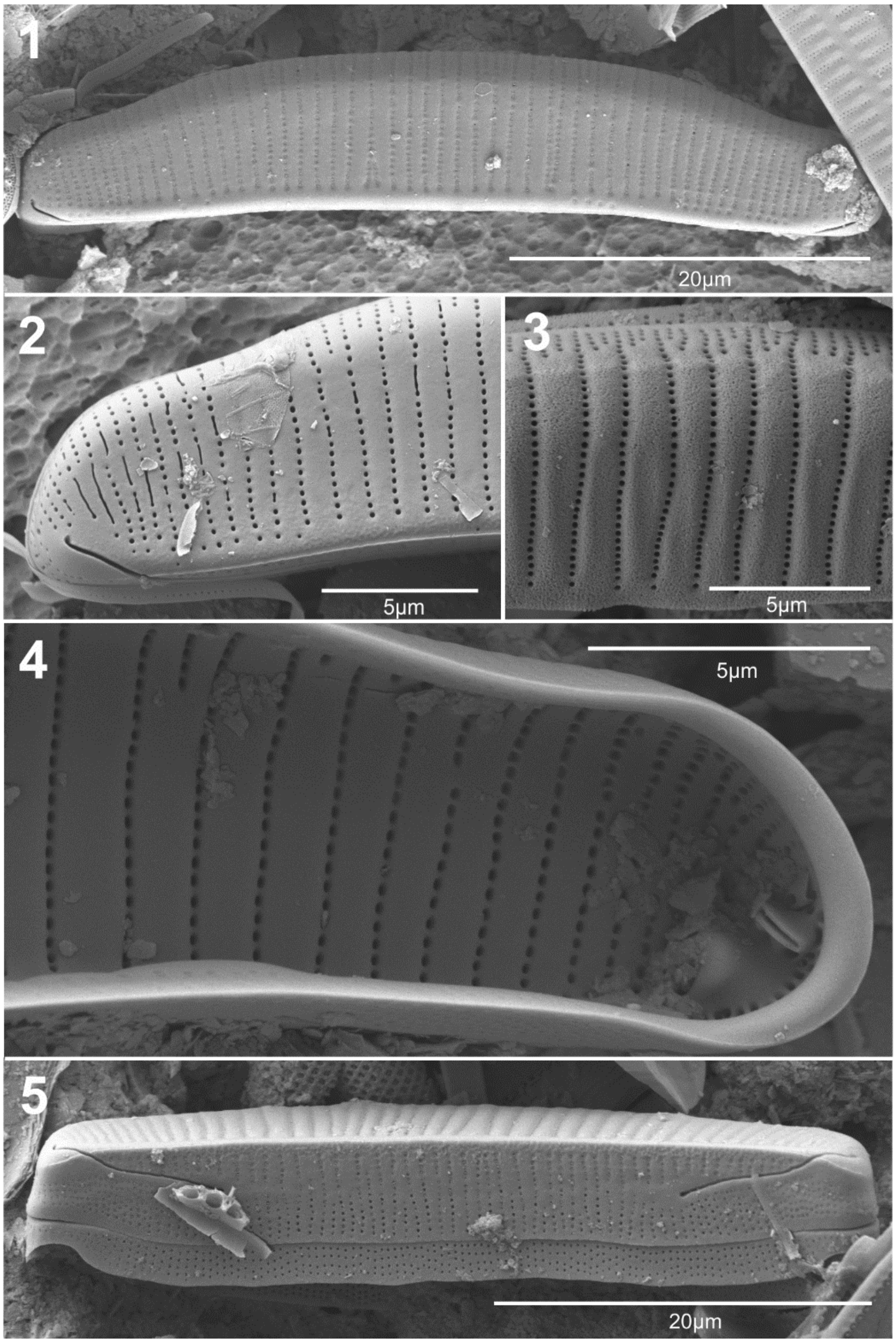

1
20µm
2
5µm
3
5µm
4
5µm
5
20µm

Plate 41

Scale Bar = 10 µm

Figs 1-19. ***Eunotia ibitipocaensis*** L.C.G. Canani & L.C. Torgan

Figs 20-28. ***Eunotia siolii*** Hustedt

Figs 29-39. ***Eunotia*** sp. nov. 5

Figs 1-19. Ribeirão do Campo reservoir, unknown. (RC2)

Figs 20-28. Type material.

Figs 29-39. Chapada Diamantina, periphyton. (SP391701)

Figs 1-19. Morphometry: Apical axis 14.7-30.1 µm; Transapical axis 3.2-5.6 µm; Striae 5-9 in 10 µm.

Figs 20-28. Morphometry: Apical axis 14.9-21.6 µm; Transapical axis 3.9-5.6 µm; Striae 13-15 in 10 µm.

Figs 29-39. Morphometry: Apical axis 15-19.8 µm; Transapical axis 2.6-3.3 µm; Striae 17-19 in 10 µm.

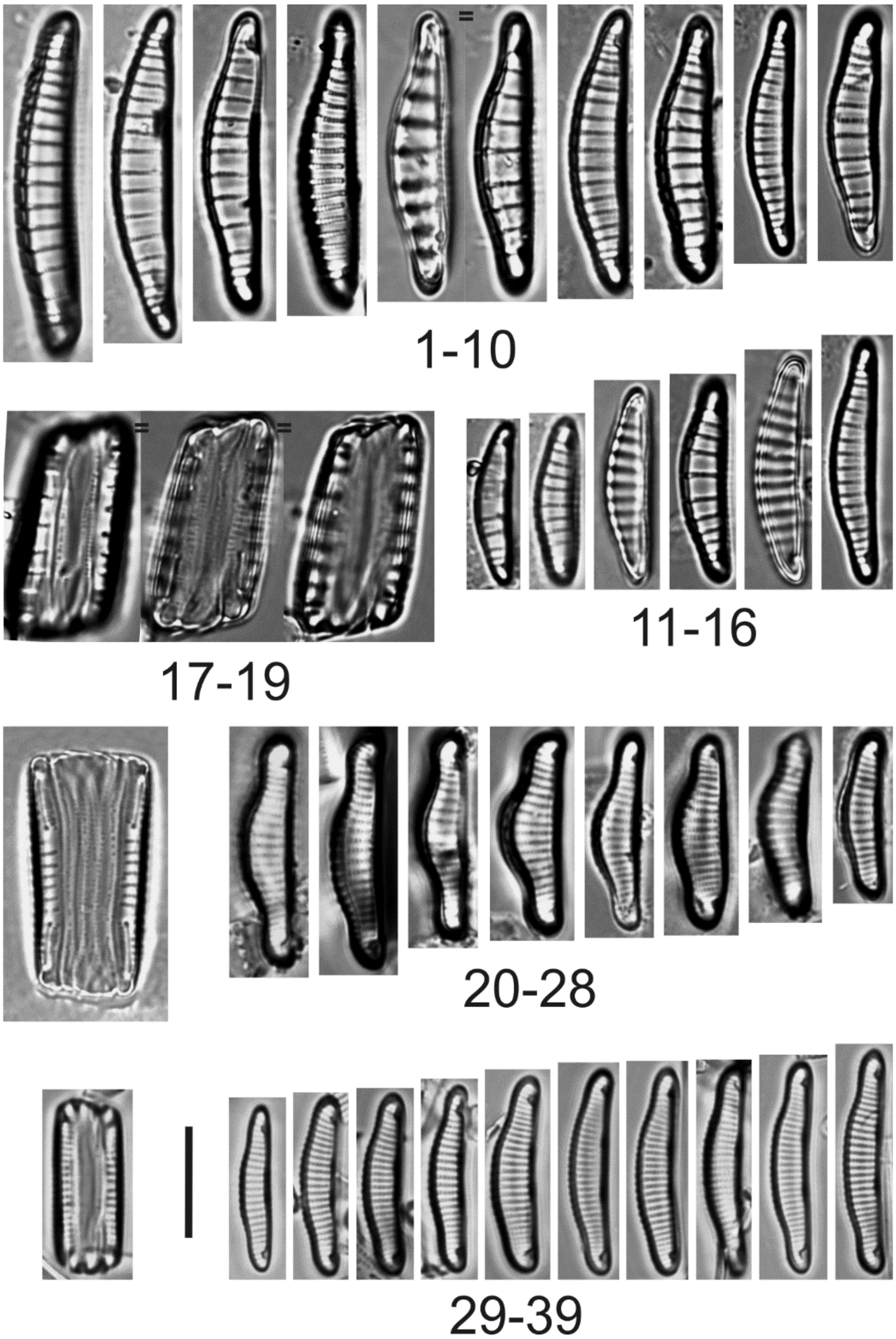

1-10
17-19
11-16
20-28
29-39

Plate 42

Scale Bar = 10 µm: Fig. 5; **5 µm**: Figs 1-3; **2 µm**: Fig. 4

Figs 1-5. *Eunotia ibitipocaensis* L.C.G. Canani & L.C. Torgan

Figs 1-5. Ribeirão do Campo reservoir, unknown. (RC2)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe.

Fig. 3. Internal valve view.

Fig. 4. Internal detail of valve view showing striae.

Fig. 5. Frustule in girdle view.

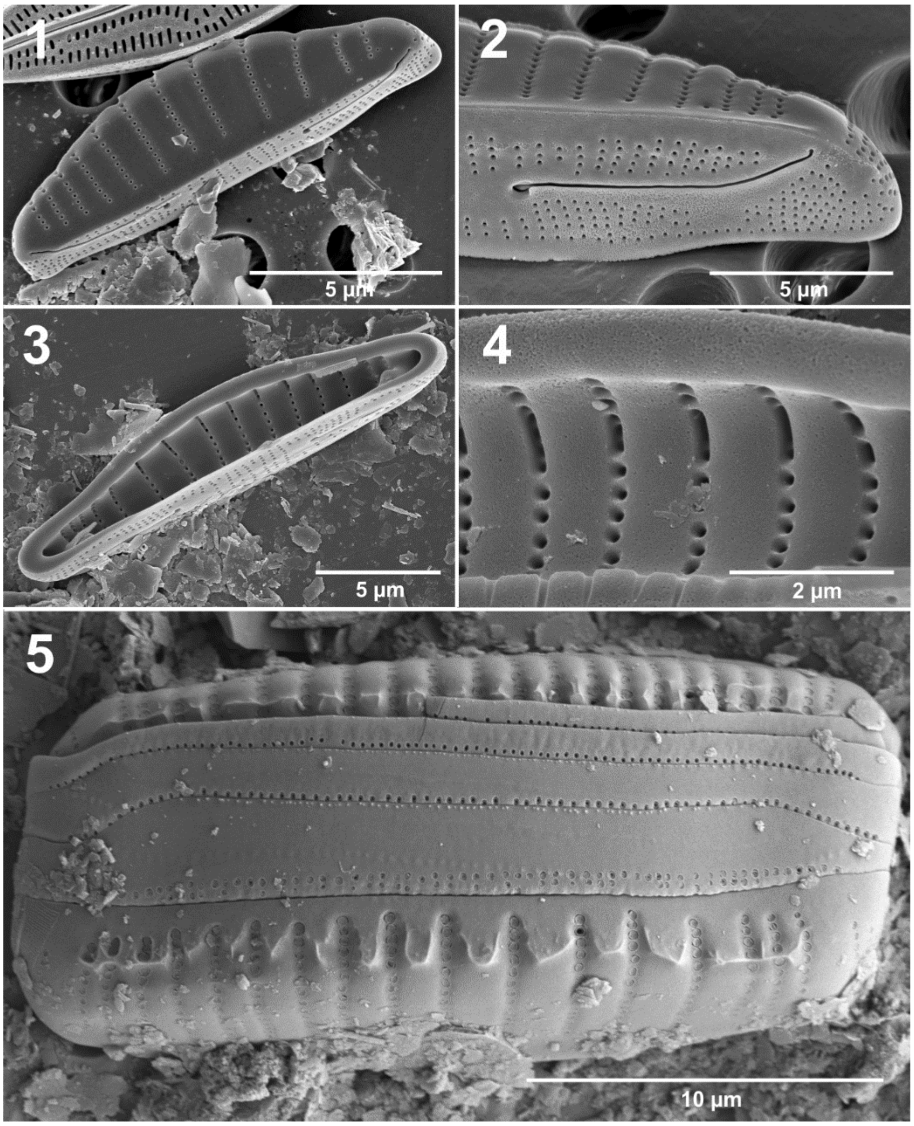

1
5 µm
2
5 µm
3
5 µm
4
2 µm
5
10 µm

Plate 43

Scale Bar = 10 µm: Figs 1-3, 5; **2 µm**: Fig. 4

Figs 1-5. *Eunotia siolii* Hustedt

Figs 1-5. Type material.

Figs 1-2. External valve view.

Fig. 3. Internal valve view.

Fig. 4. External detail of valve view showing striae.

Fig. 5. Frustule in girdle view.

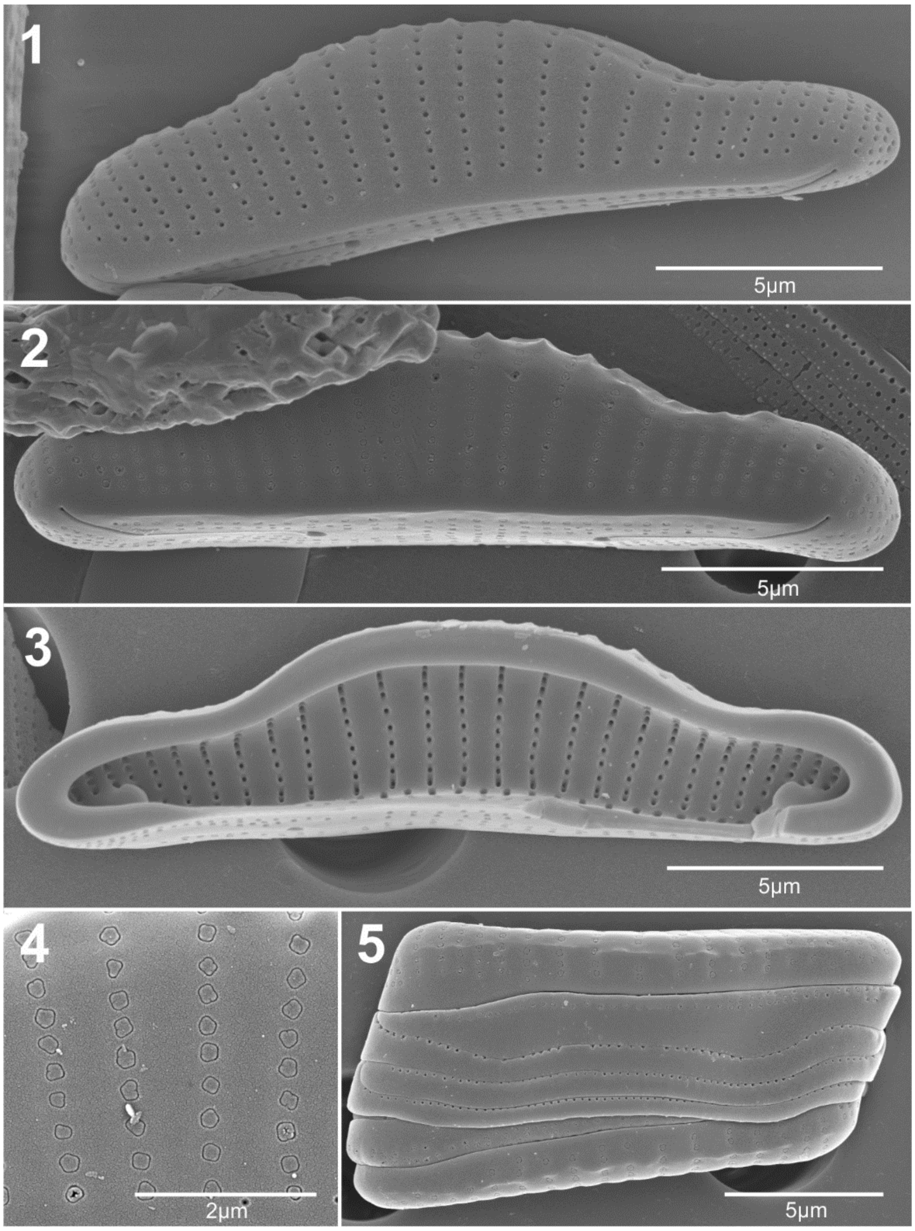

1
5µm
2
5µm
3
5µm
4
2µm
5
5µm

Plate 44

Scale Bar = 5 µm: Figs 1-2, 4; **1 µm**: Fig. 3

Figs 1-4. ***Eunotia*** sp. nov. 5

Figs 1-4. Chapada Diamantina, periphyton. (SP391701)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. Internal detail of valve view showing helictoglossae.

Fig. 4. Valve in girdle view.

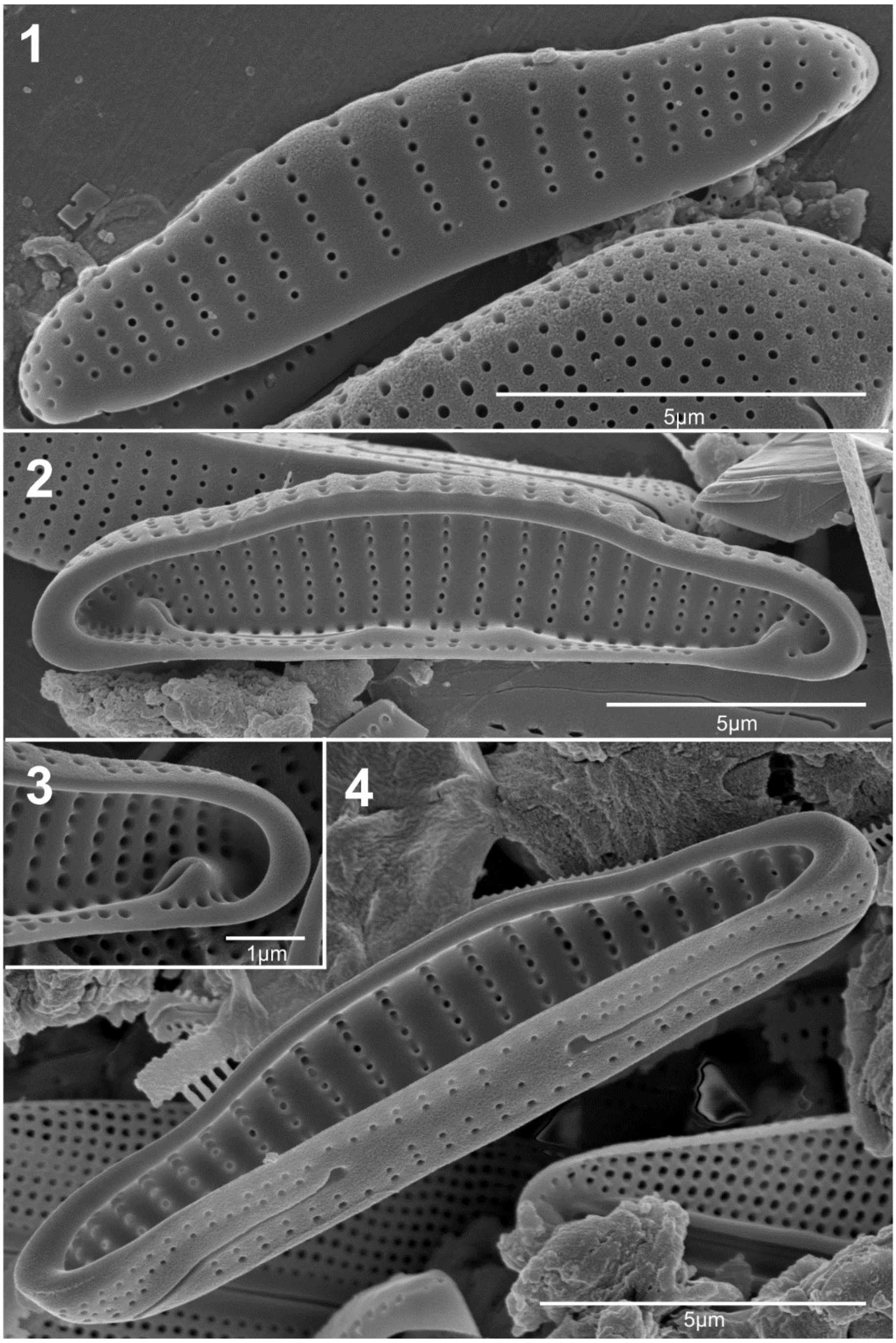

1
5μm
2
5μm
3
1μm
4
5μm

Plate 45

Scale Bar = 10 µm

Figs 1-32. *Eunotia rhomboidea* Hustedt

Figs 1-8. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 9-16. Salto Grande reservoir, periphyton. (SP469384)

Figs 17-25. Guarapiranga reservoir, phytoplankton. (SP469474)

Figs 26-32. Jundiaí reservoir, periphyton. (SP427988)

Figs 1-32. Morphometry: Apical axis 19.6-28.2 µm; Transapical axis 3.7-5.5 µm; Striae 15-18 in 10 µm.

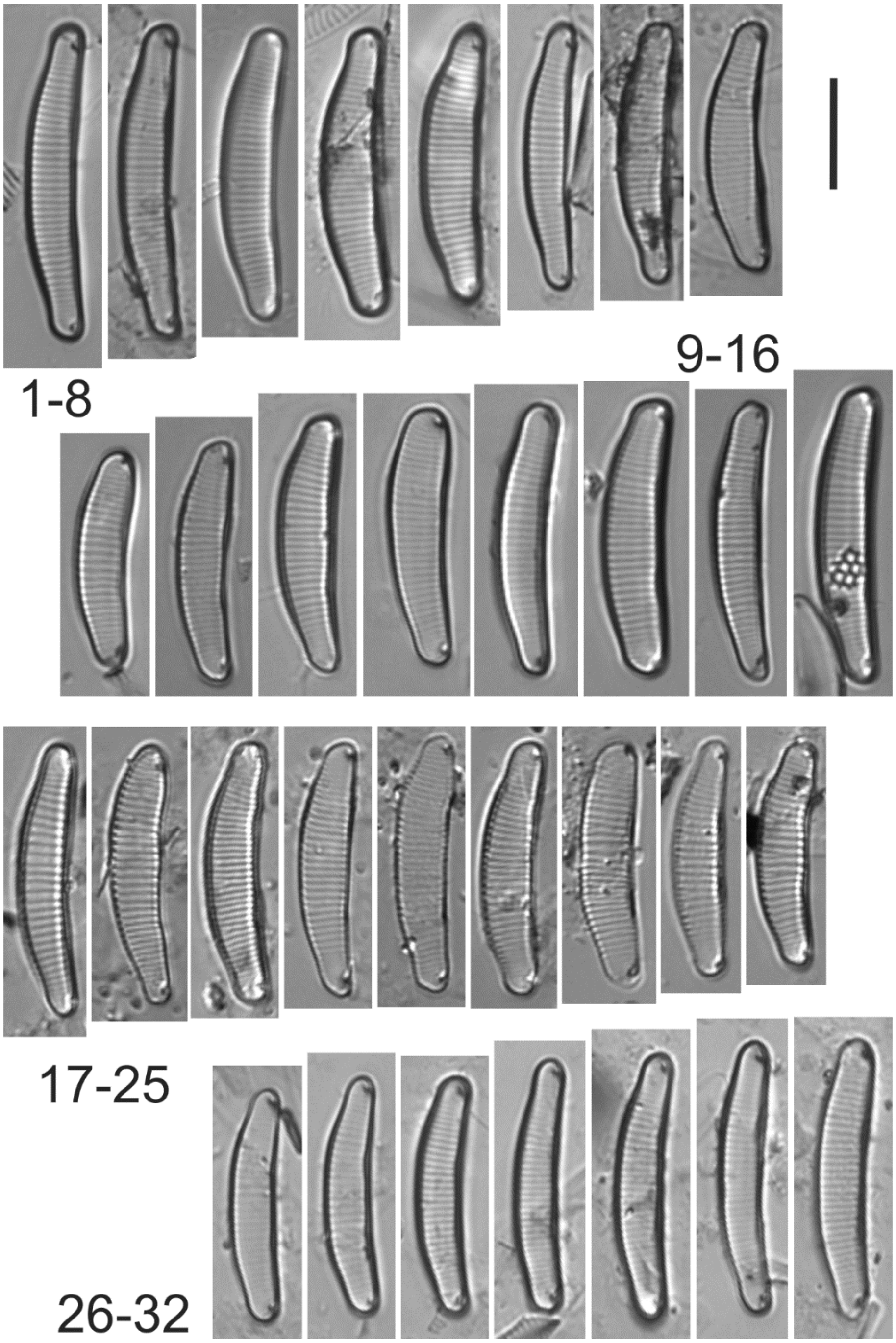

1-8
9-16
17-25
26-32

Plate 46

Scale Bar = 10 µm: Figs 1-2, 5; **2 µm**: Figs 3-4

Figs 1-5. *Eunotia rhomboidea* Hustedt

Figs 1-5. Taiaçupeba reservoir, periphyton. (SP427987)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. External detail of valve view showing raphe and rimoportula.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 5. Frustule in girdle view.

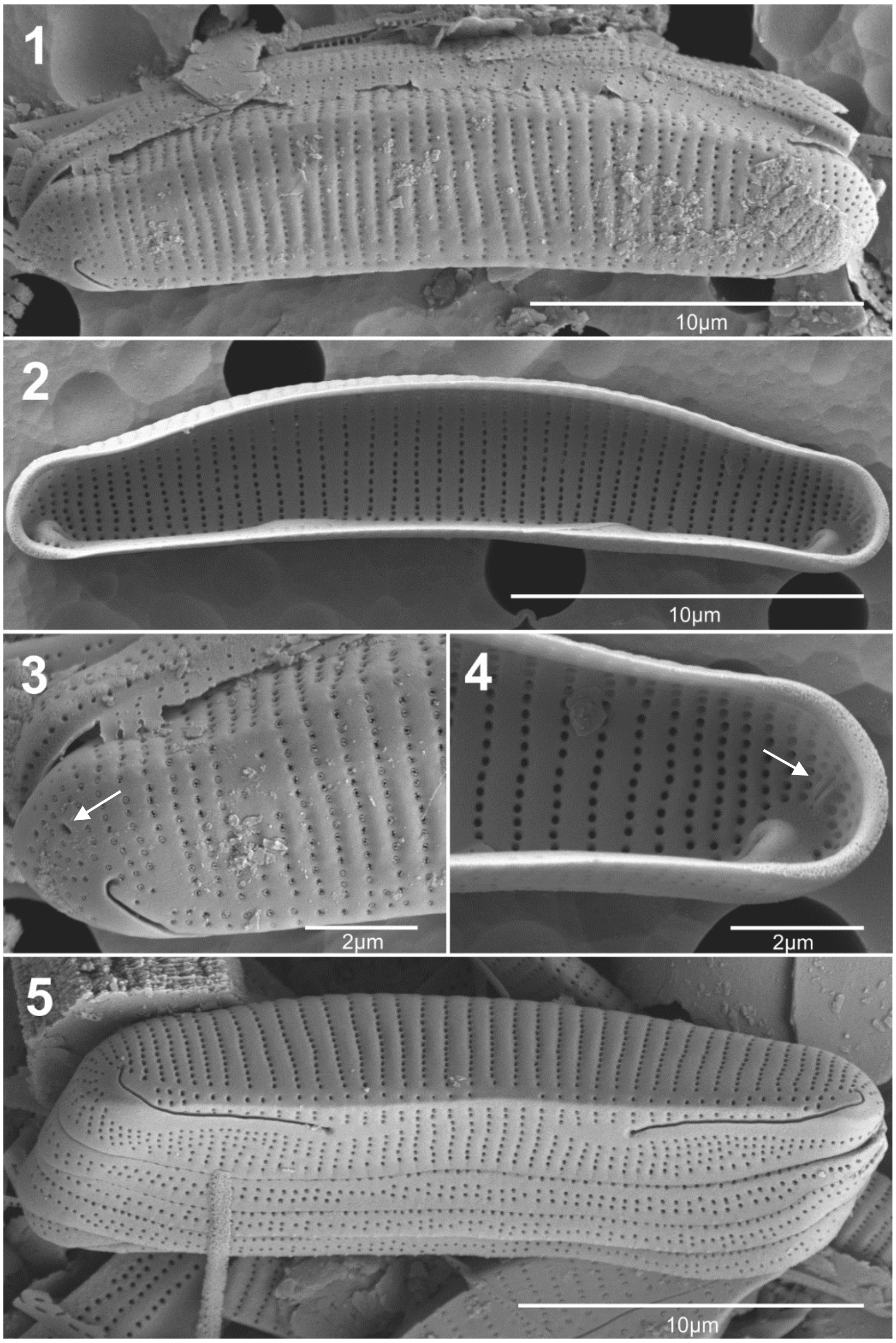

1
10µm
2
10µm
3
2µm
4
2µm
5
10µm

Plate 47

Scale Bar = 10 µm

Figs 1-11. ***Eunotia*** sp. nov. 6

Figs 12-14. ***Eunotia sennae*** M.G.M. Souza & Compère

Figs 1-5. Cabuçu reservoir, periphyton. (SP428942)

Figs 6-7. Tatu reservoir, phytoplankton. (SP469311)

Figs 8-11. Guarapiranga reservoir, surface sediment. (SP428507)

Figs 12-14. Rio Negro.

Figs 1-11. Morphometry: Apical axis 33.1-42.2 µm; Transapical axis 3.2-4.7 µm; Striae 15-18 in 10 µm.

Figs 12-14. Morphometry: Apical axis 50.9-62.1 µm; Transapical axis 5.3-6.2 µm; Striae 13-15 in 10 µm.

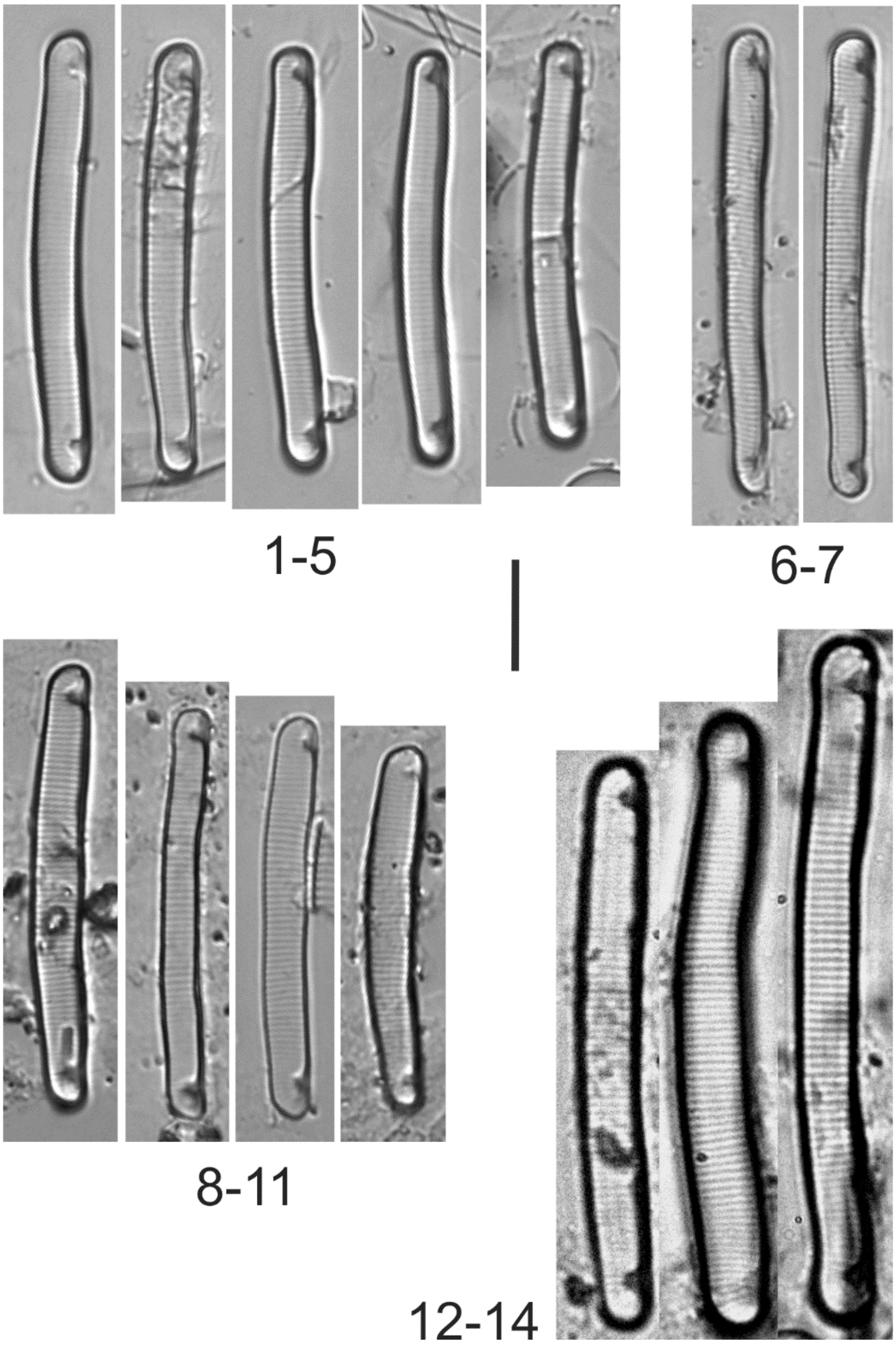

1-5
6-7
8-11
12-14

Plate 48

Scale Bar = 10 µm: Figs 1, 4; **4 µm**: Figs 5-6; **3 µm**: Fig. 2; **2 µm**: Fig. 3

Figs 1-6. *Eunotia* sp. nov. 6

Figs 1-3. Guarapiranga reservoir, surface sediment. (SP428507)

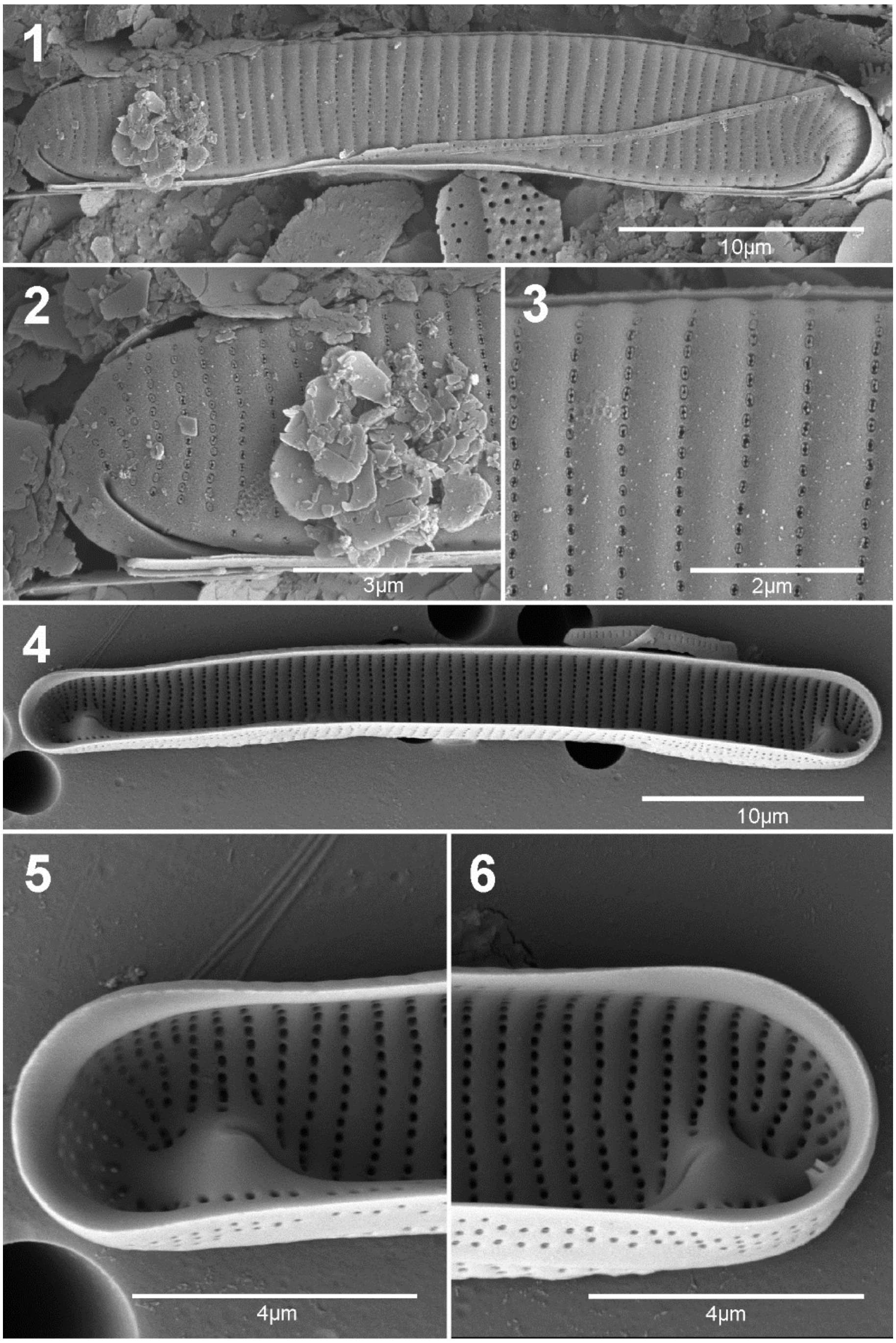
Figs 4-6. Cabuçu reservoir, periphyton. (SP428942)

Fig. 1. External valve view.

Figs 2-3. External details of valves view showing raphe and striae.

Fig. 4. Internal valve view.

Figs 5-6. Internal detail of valve view showing helictoglossae and rimoportula.



1
10μm
2
3μm
3
2μm
4
10μm
5
4μm
6
4μm

Plate 49

Scale Bar = 10 µm

Figs 1-15. ***Eunotia tukanorum*** C.E. Wetzel & D.C. Bicudo

Figs 16-24. ***Eunotia*** sp. 8

Figs 25-33. ***Eunotia loboi*** C.E. Wetzel & Ector

Figs 1-5. Ribeirão do Campo reservoir, phytoplankton. (SP427916)

Figs 6-7. Billings reservoir, periphyton. (SP427910)

Figs 8-15. Type material.

Figs 16-24. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 25-33. Type material.

Figs 1-7. Morphometry: Apical axis 14.4-27.8 µm; Transapical axis 2.5-3.3 µm; Striae 19-22 in 10 µm.

Figs 8-15. Morphometry: Apical axis 13.7-33.5 µm; Transapical axis 2.5-3 µm; Striae 21-25 in 10 µm.

Figs 16-24. Morphometry: Apical axis 23.6-40.9 µm; Transapical axis 2.7-3.5 µm; Striae 13-18 in 10 µm.

Figs 25-33. Morphometry: Apical axis 21.9-39.9 µm; Transapical axis 2.4-2.9 µm; Striae 18-20 in 10 µm.

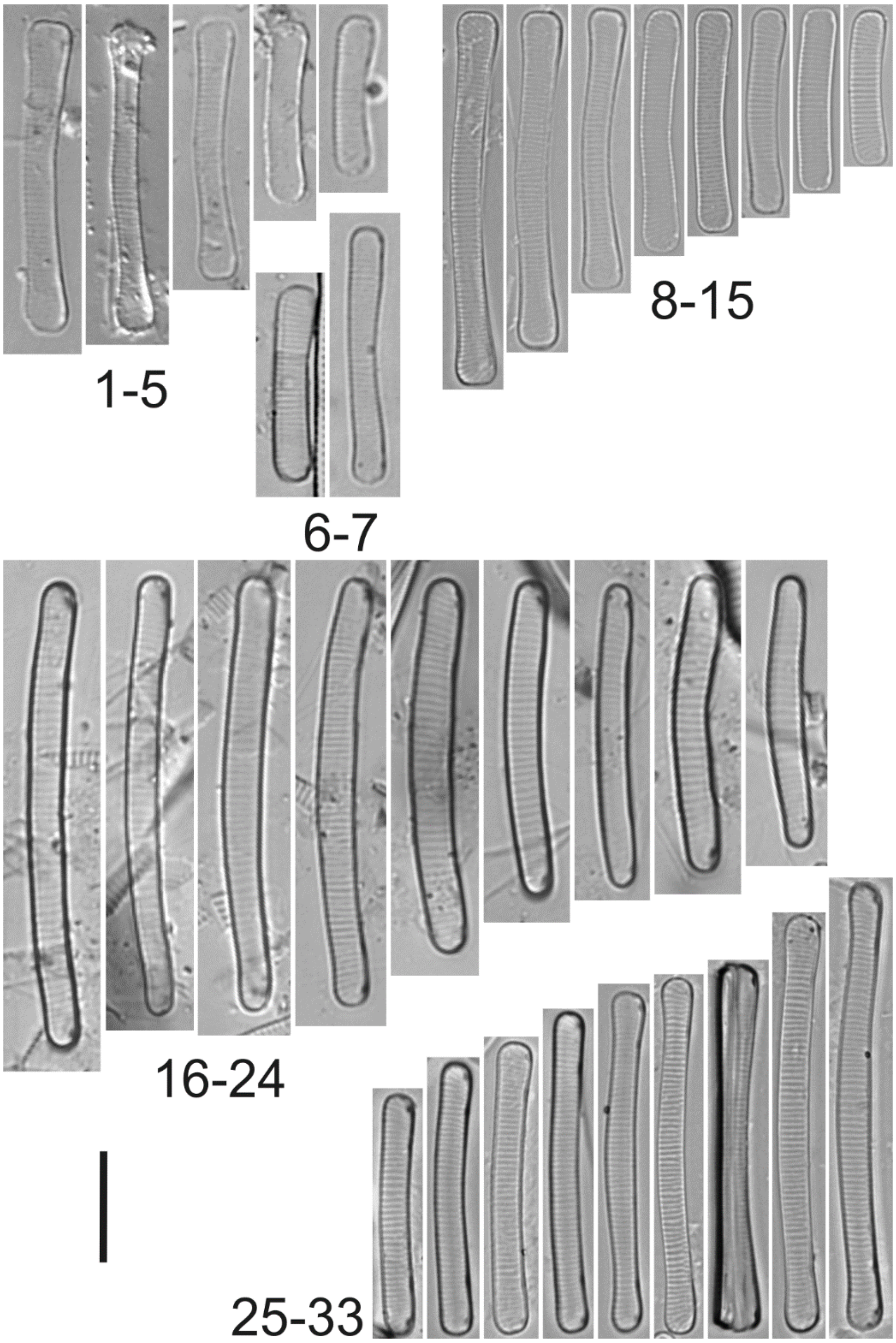

1-5
6-7
8-15
16-24
25-33

Plate 50

Scale Bar = 10 µm: Figs 1-2, 4; **1 µm**: Figs 3, 5

Figs 1-3. ***Eunotia*** sp. 8

Figs 4-5. ***Eunotia loboi*** C.E. Wetzel & Ector

Figs 1-3. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 4-5. Type material.

Figs 1-2, 4. External valve view.

Figs 3, 5. Internal detail of valve view showing helictoglossae and rimoportula.

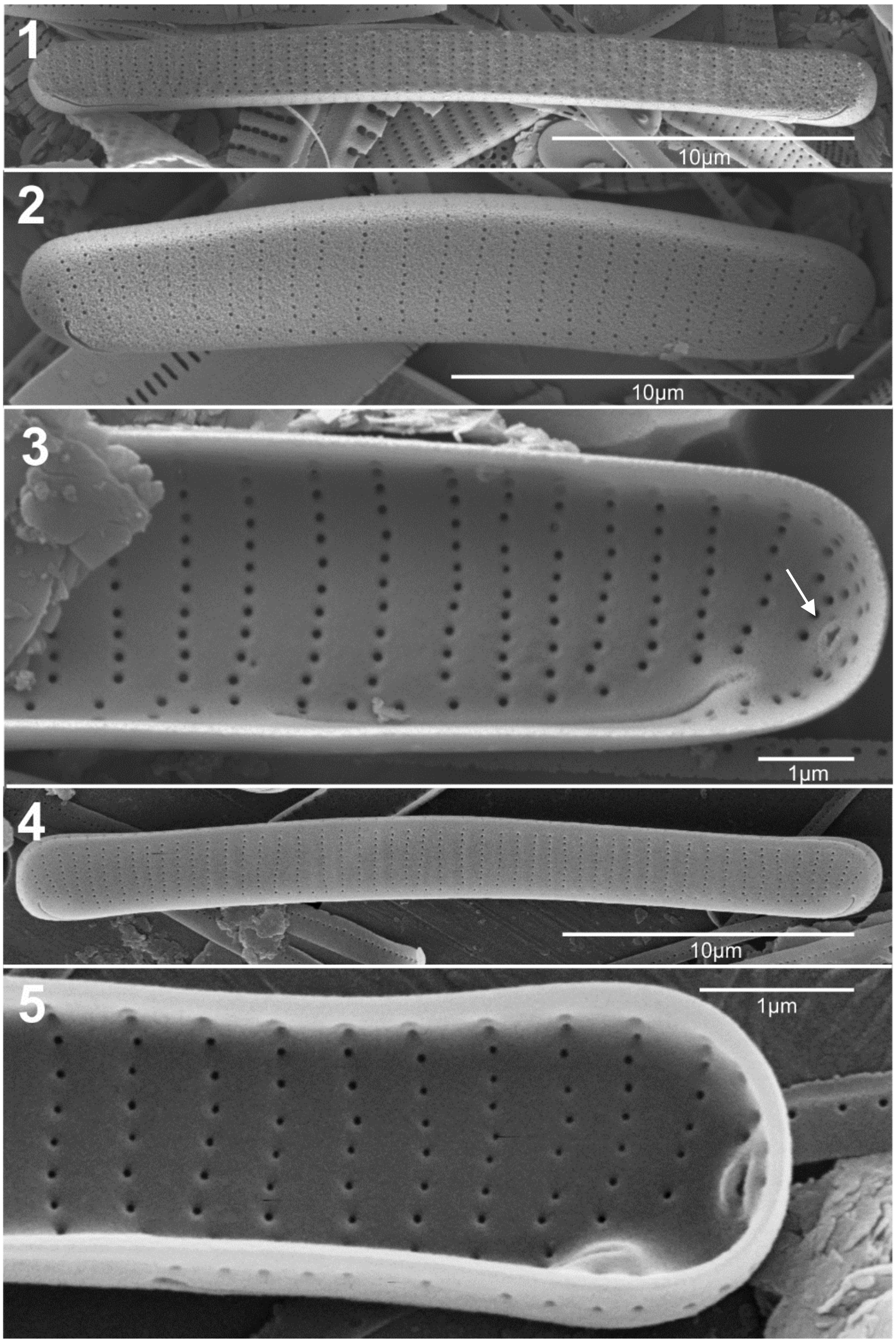

1
10µm
2
10µm
3
1µm
4
10µm
5
1µm

Plate 51

Scale Bar = 10 µm

Figs 1-21. *Eunotia waimiriorum* C.E. Wetzel

Figs 22-28. *Eunotia gomesii* C.E. Wetzel & Ector *sensu* Wetzel *et al.* 2010

Figs 29-36. *Eunotia waimiriorum* C.E. Wetzel sensu Wetzel *et al*. 2010

Figs 1-11. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 12-21. Jurupará reservoir, surface sediment. (SP469211)

Figs 22-36. Type material.

Figs 1-21. Morphometry: Apical axis 13.3-47 µm; Transapical axis 1.8-3 µm; Striae 15-20 in 10 µm.

Figs 22-28. Morphometry: Apical axis 21.5-49.6 µm; Transapical axis 1.7-2.3 µm; Striae 18-22 in 10 µm.

Figs 29-36. Morphometry: Apical axis 14.8-26.4 µm; Transapical axis 2-2.5 µm; Striae 21-24 in 10 µm.

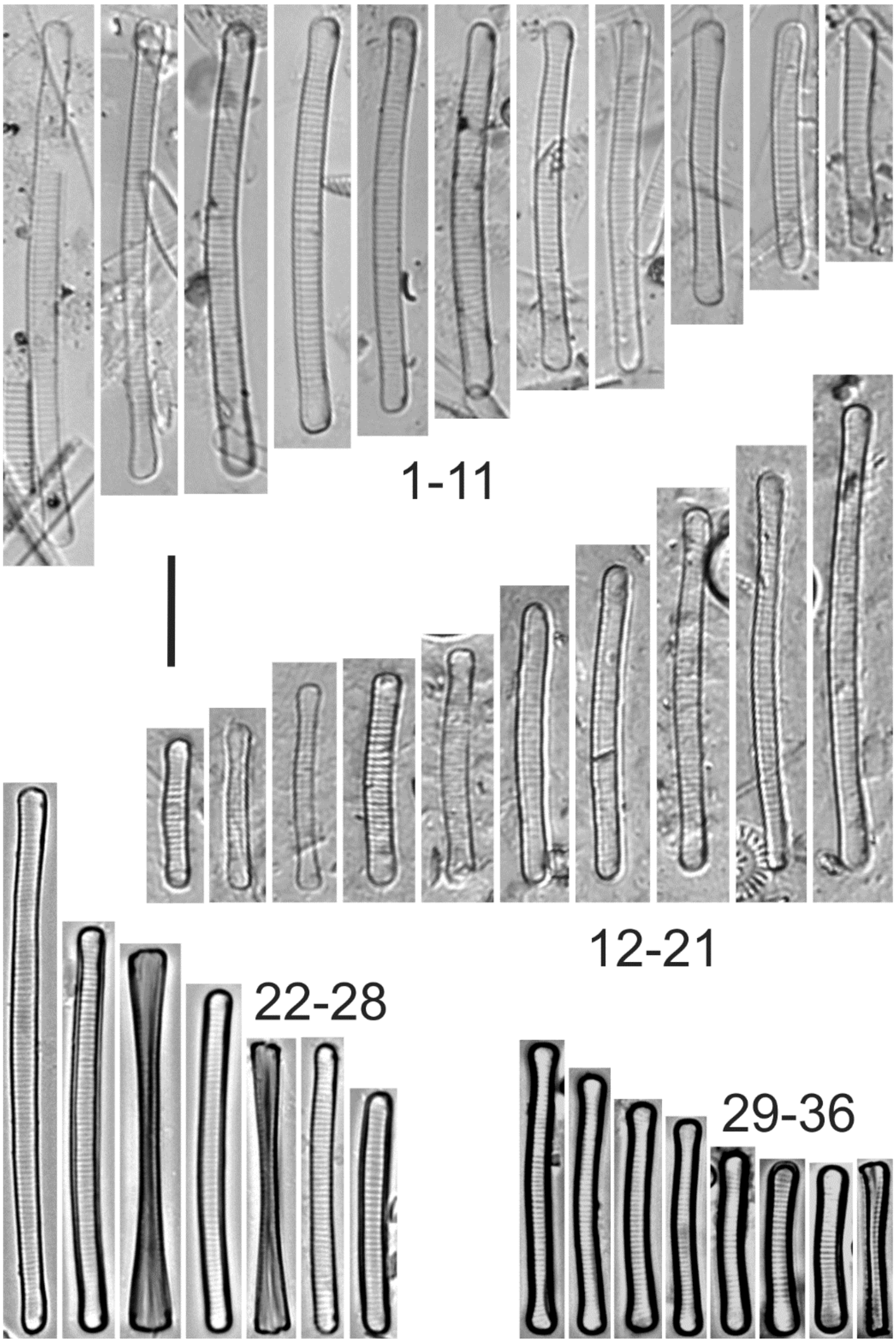

1-11
12-21
22-28
29-36

Plate 52

Scale Bar = 10 µm

Figs 1-35. *Eunotia waimiriorum* C.E. Wetzel

Figs 1-11. Cachoeira do França reservoir, surfasse sediment. (SP469297)

Figs 12-18. Billings reservoir, periphyton. (SP428512)

Figs 19-24. Atibainha reservoir, surface sediment. (SP469255)

Figs 25-29. Jundiaí reservoir, periphyton. (SP427989)

Figs 30-35. Ponte Nova reservoir, phytoplankton. (SP427983)

Figs 1-35. Morphometry: Apical axis 14.3-35.5 µm; Transapical axis 1.5-2.8 µm; Striae 15-22 in 10 µm.

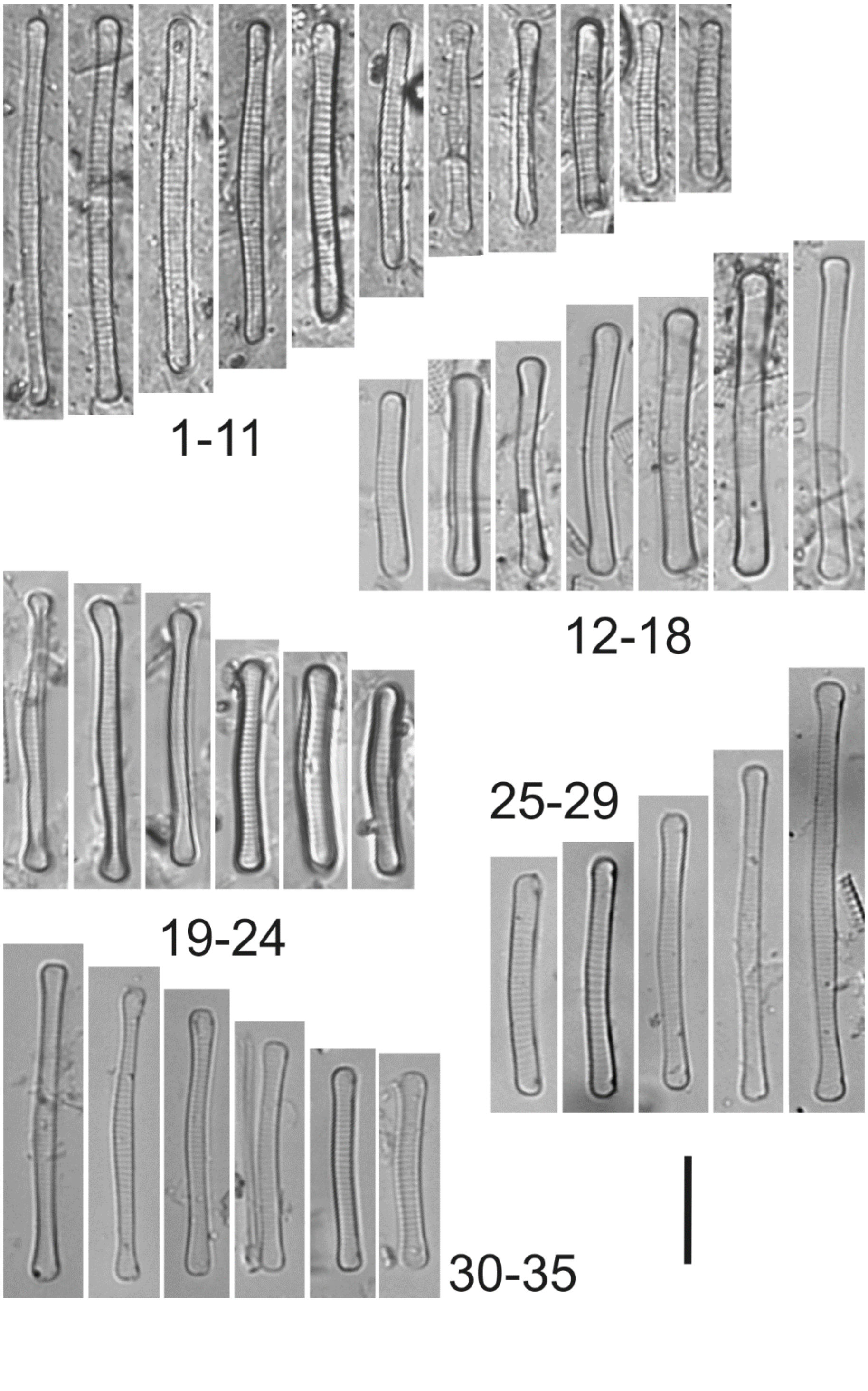

1-11
12-18
19-24
25-29
30-35

Plate 53

Scale Bar = 10 µm: Figs 2-4; **5 µm**: Fig. 1; **3 µm**: Fig. 5

Figs 1-5. *Eunotia waimiriorum* C.E. Wetzel

Figs 1-3. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 4-5. Taiaçupeba reservoir, surface sediment. (SP468857)

Figs 1-2. External valve view.

Fig. 3. Internal valve view showing the helictoglossae and rimoportula.

Fig. 4. Frustule in girdle view.

Fig 5. Detail of raphe and spines.

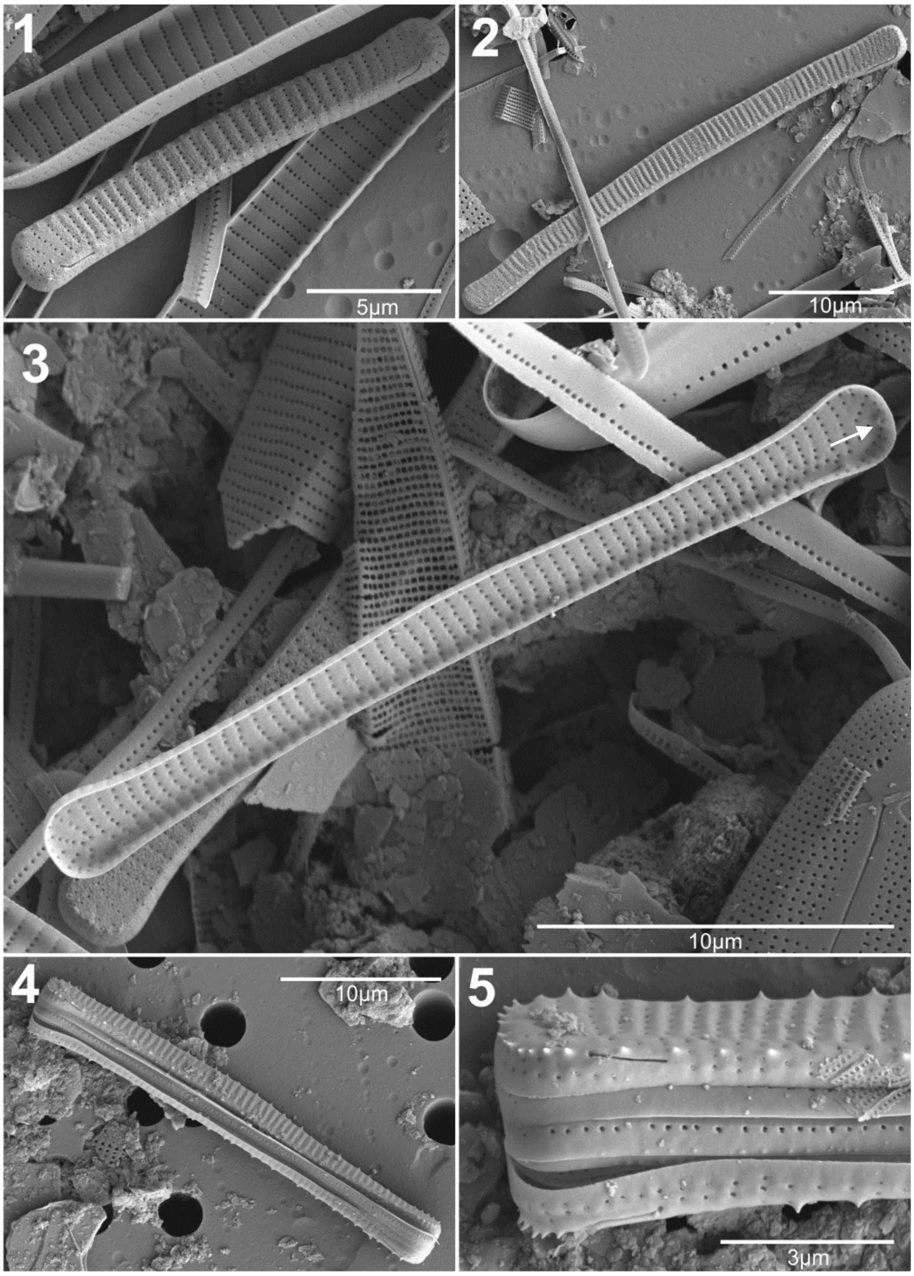

1
5µm
2
10µm
3
10µm
4
10µm
5
3µm

Plate 54

Scale Bar = 10 µm: Figs 1-34; **5 µm**: Figs 35-37

Figs 1-37. *Eunotia kruegeri* Lange-Bertalot

Figs 1-5. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 6-11. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 12-17. Cabuçu reservoir, surface sediment. (SP428921)

Figs 18-20. Ribeirão do Campo reservoir, periphyton. (SP427928)

Figs 21-22. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 23-28. Jurupará reservoir, periphyton. (SP469491)

Figs 29-34. Paineiras reservoir, periphyton. (SP469505)

Figs 35-37. Pedro Beicht reservoir, phytoplankton. (SP427595)

Figs 35-36. External valve view.

Fig. 37. Internal valve view.

Figs 1-37. Morphometry: Apical axis 10.3-18 µm; Transapical axis 2-3.1 µm; Striae 20-25 in 10 µm.

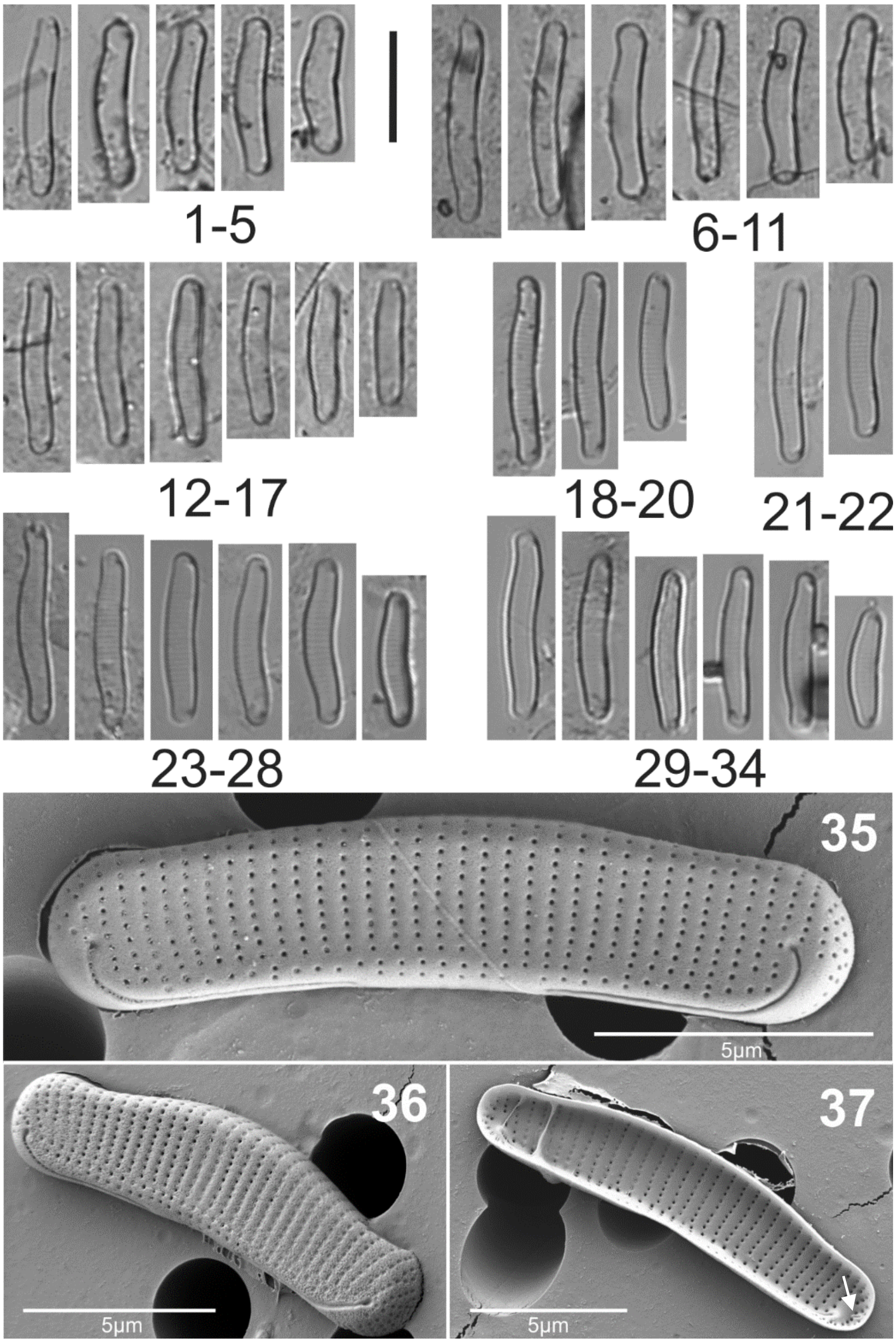

1-5
6-11
12-17
18-20
21-22
23-28
29-34
35
5µm
36
5µm
37
5µm

Plate 55

Scale Bar = 10 µm

Figs 1-7. ***Eunotia*** sp. nov. 7

Figs 8-11. ***Eunotia*** sp. 9

Figs 12-43. ***Eunotia muscicola*** Krasske

Figs 44-54. ***Eunotia vixexigua*** Metzeltin & Lange-Bertalot

Figs 1-4, 8-9. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 5-7. Ribeirão do Campo reservoir, surface sediment. (SP468841)

Figs 10-11, 44-49. Cabuçu reservoir, surface sediment. (SP428921)

Figs 12-17. Cabuçu reservoir, surface sediment. (SP428923)

Figs 18-22. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 23-26. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 27-33. Jurupará reservoir, periphyton. (SP469491)

Figs 34-37. Cachoeira do França reservoir, periphyton. (SP469450)

Figs 38-43. Ribeirão do Campo reservoir, periphyton. (SP427928)

Figs 50-54. Guarapiranga reservoir, surface sediment. (SP428507)

Figs 1-7. Morphometry: Apical axis 16.5-20.7 µm; Transapical axis 2.3-2.7 µm; Striae 23-24 in 10 µm. Figs 8-11. Morphometry: Apical axis 11.6-19.7 µm; Transapical axis 2.3-2.6 µm; Striae 16-19 in 10 µm. Figs 12-43. Morphometry: Apical axis 10.5-15.9 µm; Transapical axis 2.7-3.6 µm; Striae 20-25 in 10 µm. Figs 44-54. Morphometry: Apical axis 14-18.2 µm; Transapical axis 2.9-3.4 µm; Striae 19-21 in 10 µm.

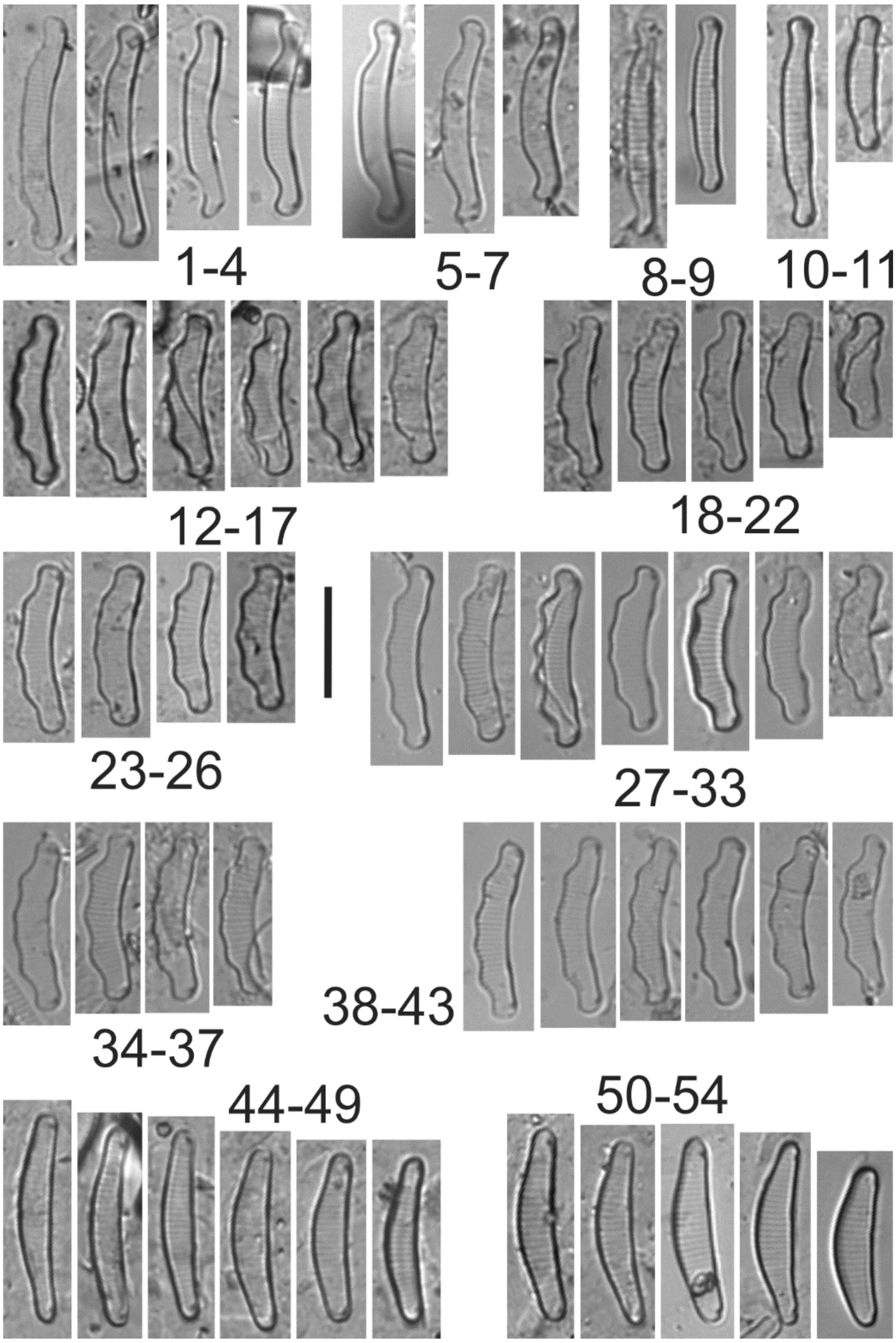

1-4
5-7
8-9
10-11
12-17
18-22
23-26
27-33
34-37
38-43
44-49
50-54

Plate 56

Scale Bar = 5 µm: Figs 1-2; **1 µm**: Fig. 3

Figs 1-3. ***Eunotia*** sp. nov. 7

Figs 1-3. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. Internal detail of valve view showing helictoglossae and rimoportula.

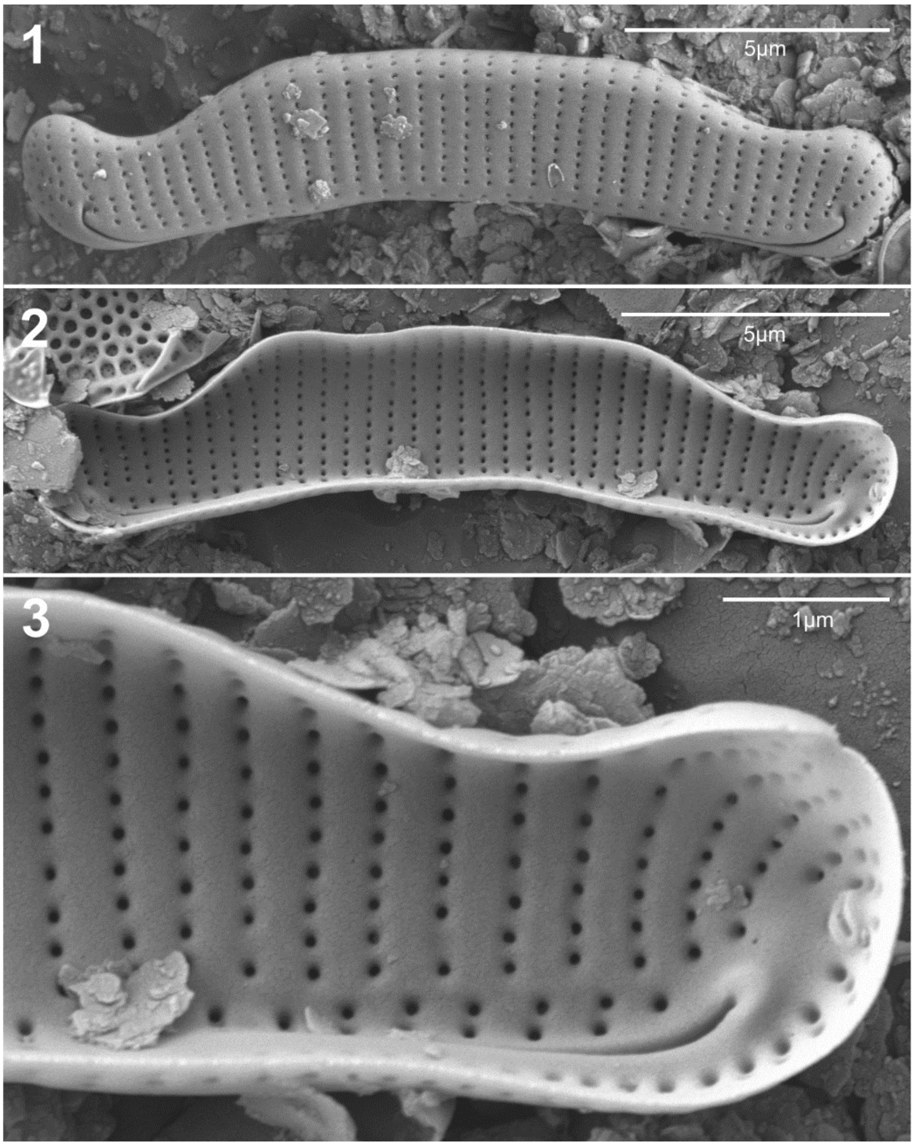

1
5µm
2
5µm
3
1µm

Plate 57

Scale Bar = 5 µm: Figs 1-3

Figs 1-3. ***Eunotia muscicola*** Krasske

Figs 1-3. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 1-2. External valve view.

Fig. 3. Internal valve view.

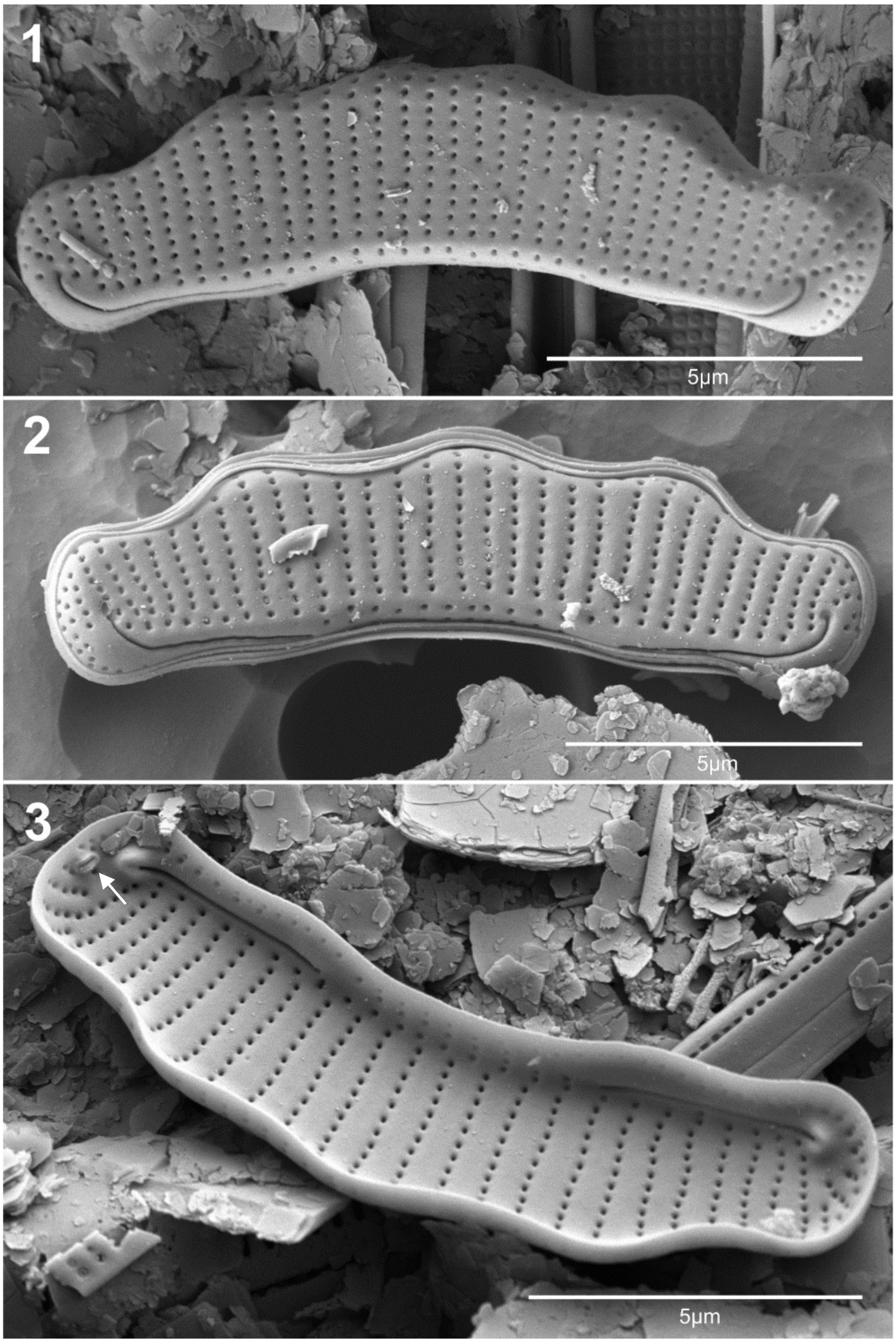

1
5µm
2
5µm
3
5µm

Plate 58

Scale Bar = 10 µm

Figs 1-10. ***Eunotia incisatula*** Metzeltin & Lange-Bertalot

Figs 11-46. ***Eunotia*** sp. nov. 8

Figs 47-56. ***Eunotia botuliformis*** Wild, Nörpel & Lange-Bertalot

Figs 1-21. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 22-30. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 31-40. Ribeirão do Campo reservoir, periphyton. (SP427982)

Figs 41-46. Guarapiranga reservoir, surface sediment. (SP428507)

Figs 47-56. Luxembourg.

Figs 1-10. Morphometry: Apical axis 15-30.7 µm; Transapical axis 2.3-3.6 µm; Striae 13-18 in 10 µm.

Figs 11-46. Morphometry: Apical axis 9.2-17.6 µm; Transapical axis 2-3.7 µm; Striae 15-20 in 10 µm.

Figs 47-56. Morphometry: Apical axis 11.7-31.9 µm; Transapical axis 3-4.3 µm; Striae 17-19 in 10 µm.

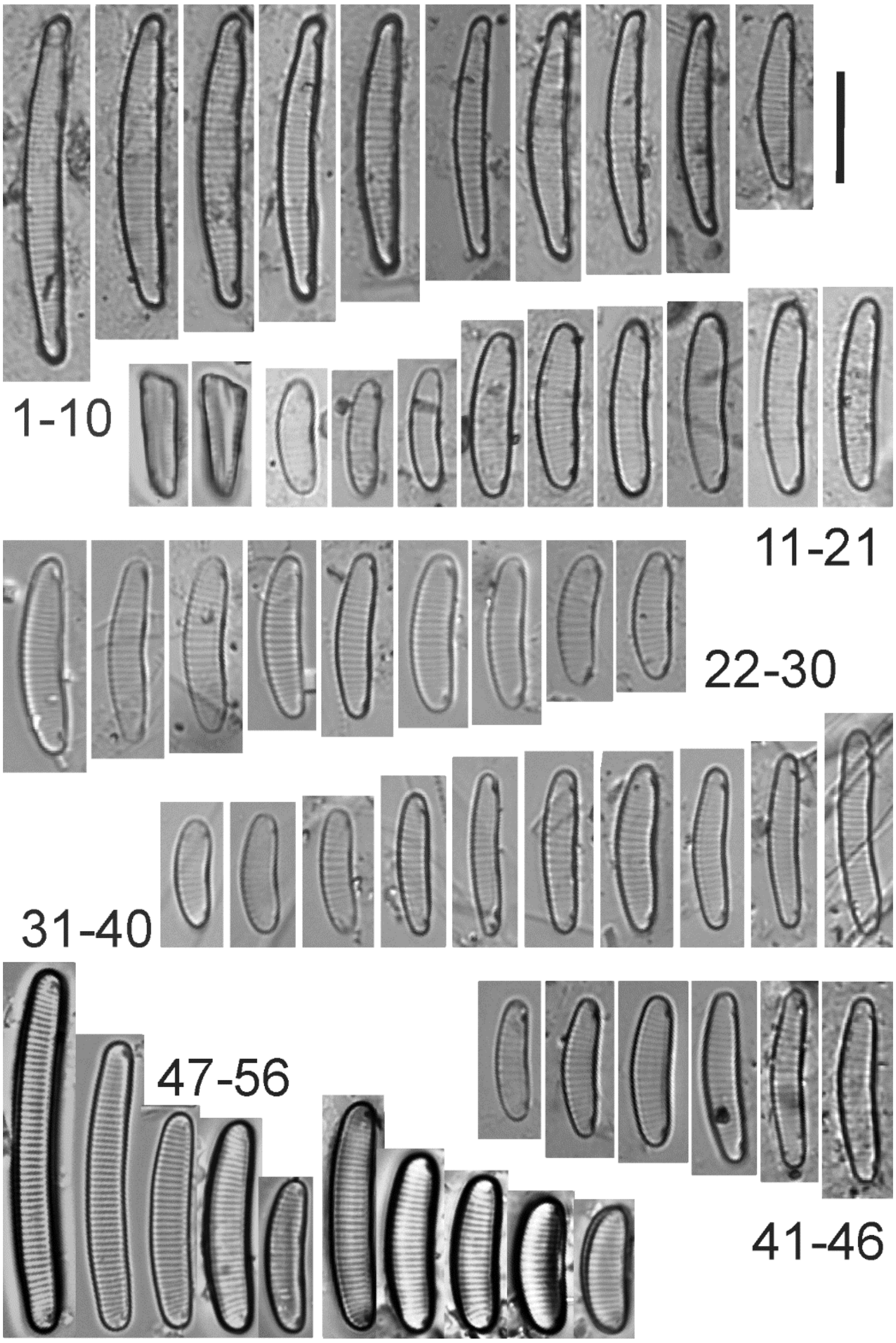

1-10
11-21
22-30
31-40
47-56
41-46

Plate 59

Scale Bar = 5 µm: Figs 2-3; **4 µm**: Fig. 1

Figs 1-3. ***Eunotia*** sp. nov. 8

Figs 1-3. Pedro Beicht reservoir, surface sediment. (SP427581)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. Frustules in girdle view.

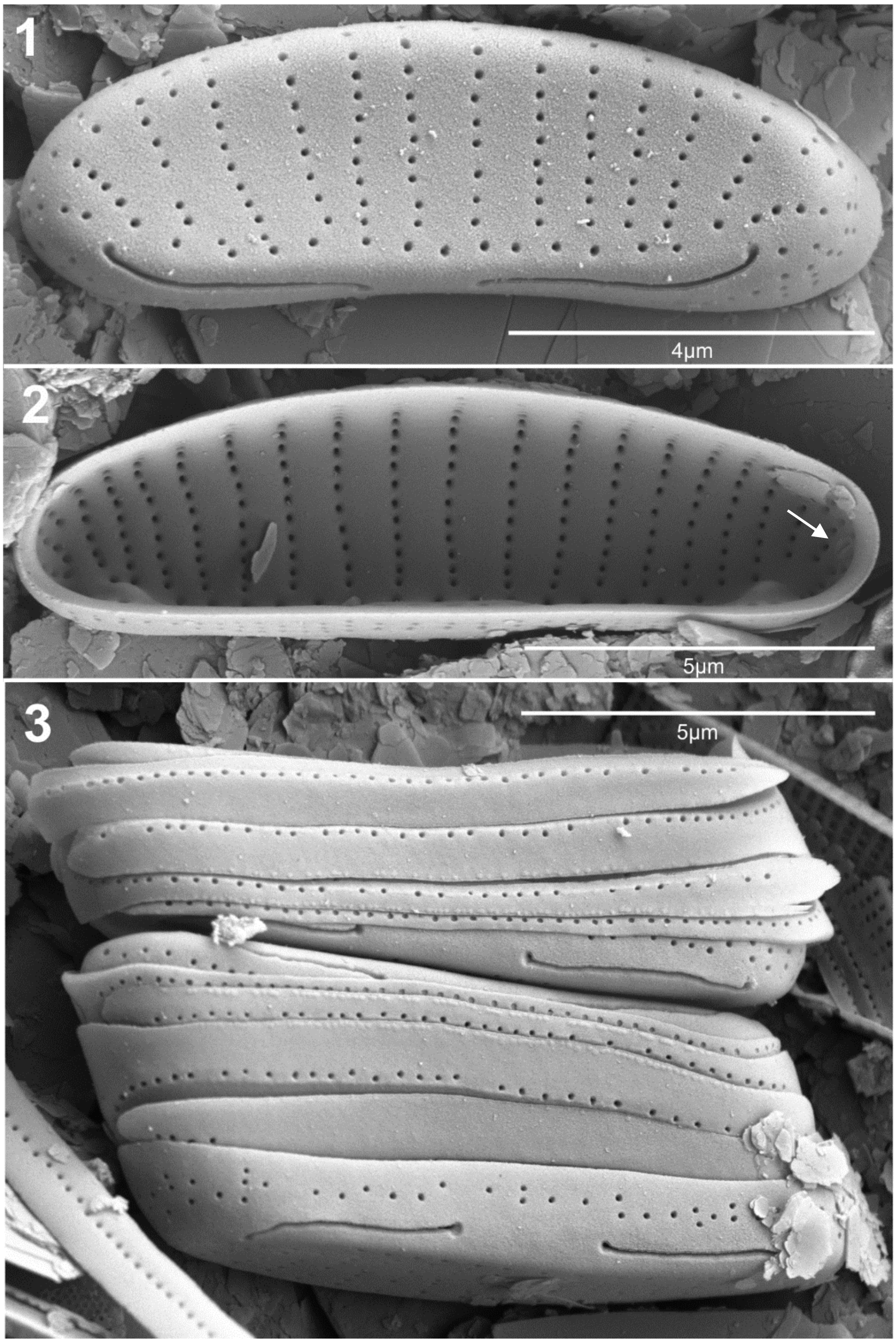

1
4μm
2
5μm
3
5μm

Plate 60

Scale Bar = 5 µm: Figs 1-4

Figs 1-2. *Eunotia incisatula* Metzeltin & Lange-Bertalot

Figs 3-4. *Eunotia fallax* var. *aequalis* Hustedt

Figs 1-2. Ribeirão do Campo reservoir, periphyton. (SP427982).

Figs 3-4. Type material.

Figs 1, 3. External valve view.

Figs 2, 4. Internal valve view showing helictoglossae and rimoportula.

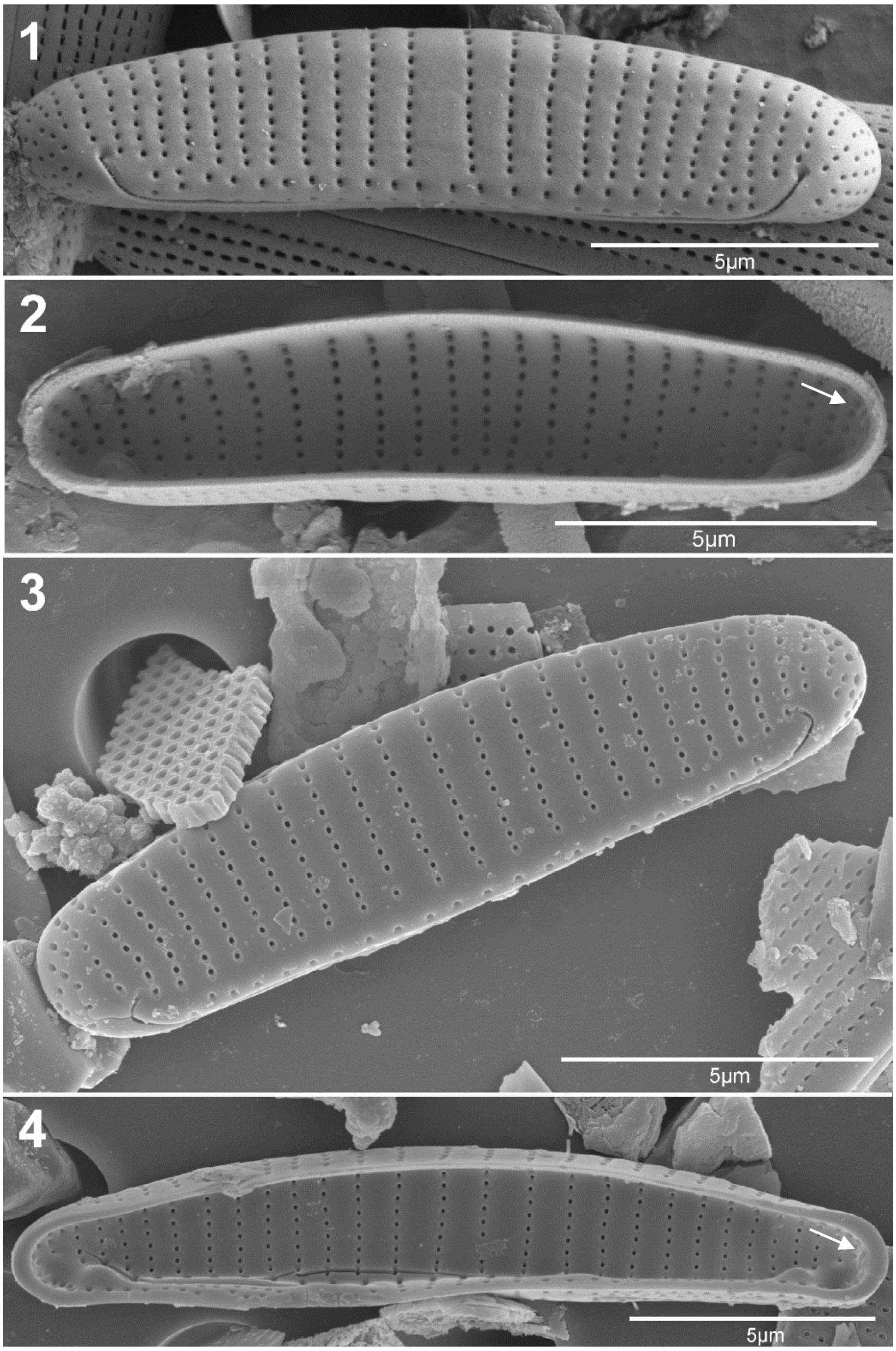

1
5µm
2
5µm
3
5µm
4
5µm

Plate 61

Scale Bar = 10 µm: Fig. 4; **5 µm**: Fig. 3; **3 µm**: Figs 1-2, 5; **2 µm**: Fig. 6

Figs 1-3. ***Eunotia*** sp. nov. 8

Figs 4-6. ***Eunotia botuliformis*** Wild, Nörpel & Lange-Bertalot

Figs 1-3. Rio Negro.

Figs 4-6. Luxembourg.

Figs 1, 6. External valve view.

Figs 2, 4. Internal valve view.

Fig. 3. Frustule in girdle view.

Fig. 5. Internal detail of valve view showing helictoglossae and rimoportula.

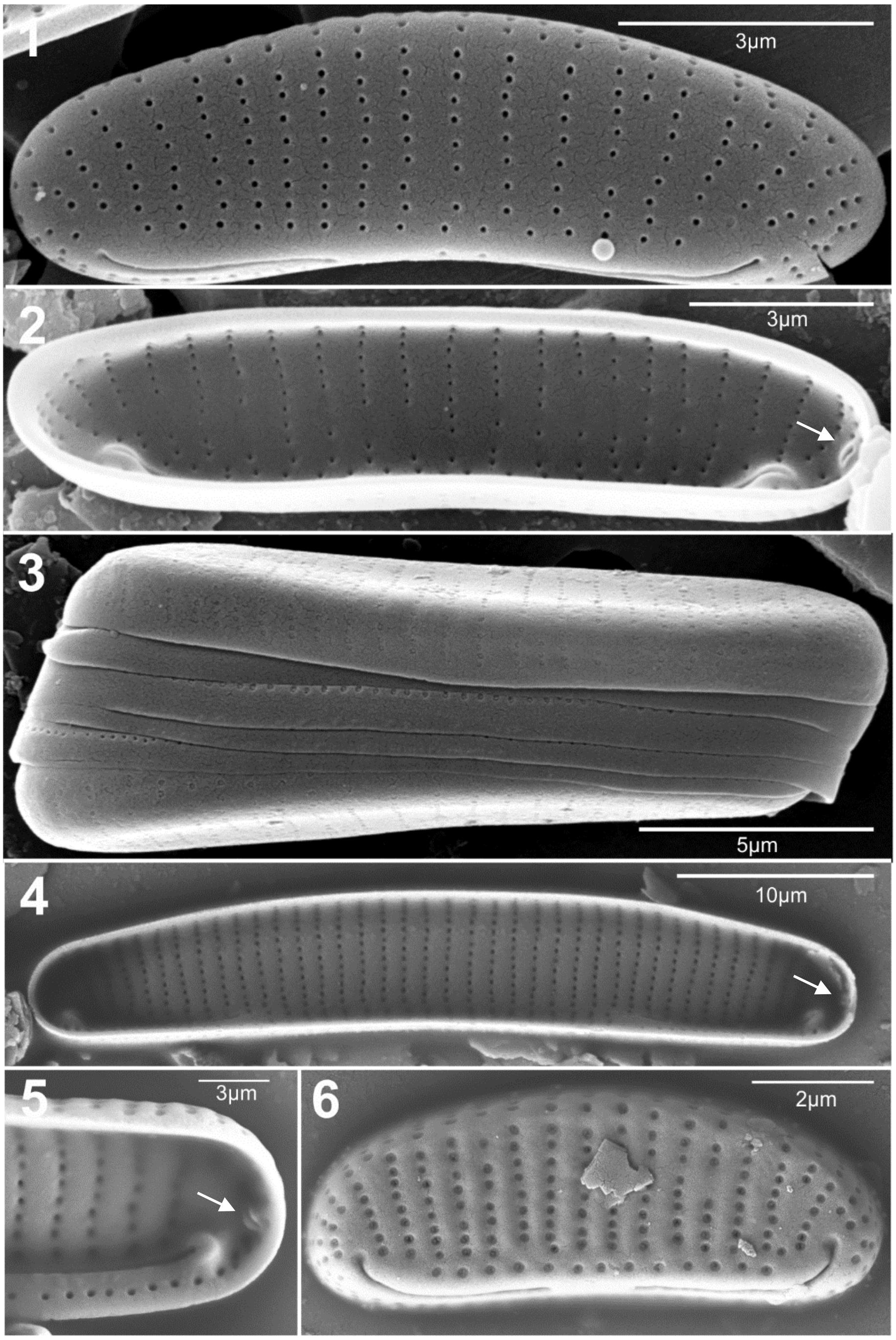

1
3µm
2
3µm
3
5µm
4
10µm
5
3µm
6
2µm

Plate 62

Scale Bar = 10 µm

Figs 1-14. *Eunotia rabenhorstii* var. *monodon* Cleve & Grunow

Figs 15-17. *Eunotia rabenhorstii* var. *triodon* Cleve & Grunow

Figs 18-20. *Eunotia pyramidata* var. *pryramidata* f. *capitata* Krasske
Figs 21-22. *Eunotia pyramidata* var. *monodon* Krasske

Figs 1-4. Jundiaí reservoir, surface sediment. (SP468850)

Figs 5-7. Guarapiranga reservoir, surface sediment. (SP428508)

Figs 8-12. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 13-14. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 15-16, 18. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 17, 19-20. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Fig. 21. Serraria reservoir, surface sediment. (SP469204)

Fig. 22. Billings reservoir, surface sediment. (SP401589)

Figs 1-14. Morphometry: Apical axis 11.3-23.4 µm; Transapical axis 5.5-7.3 µm; Striae 12-18 in 10 µm.

Figs 15-17. Morphometry: Apical axis 26.4-28.8 µm; Transapical axis 6.9-7.7 µm; Striae 11-13 in 10 µm.

Figs 18-20. Morphometry: Apical axis 25.3-26.8 µm; Transapical axis 5.3-6.3 µm; Striae 12-15 in 10 µm.

Figs 21-22. Morphometry: Apical axis 20.7-21.7 µm; Transapical axis 6.7-6.8 µm; Striae 13-15 in 10 µm.

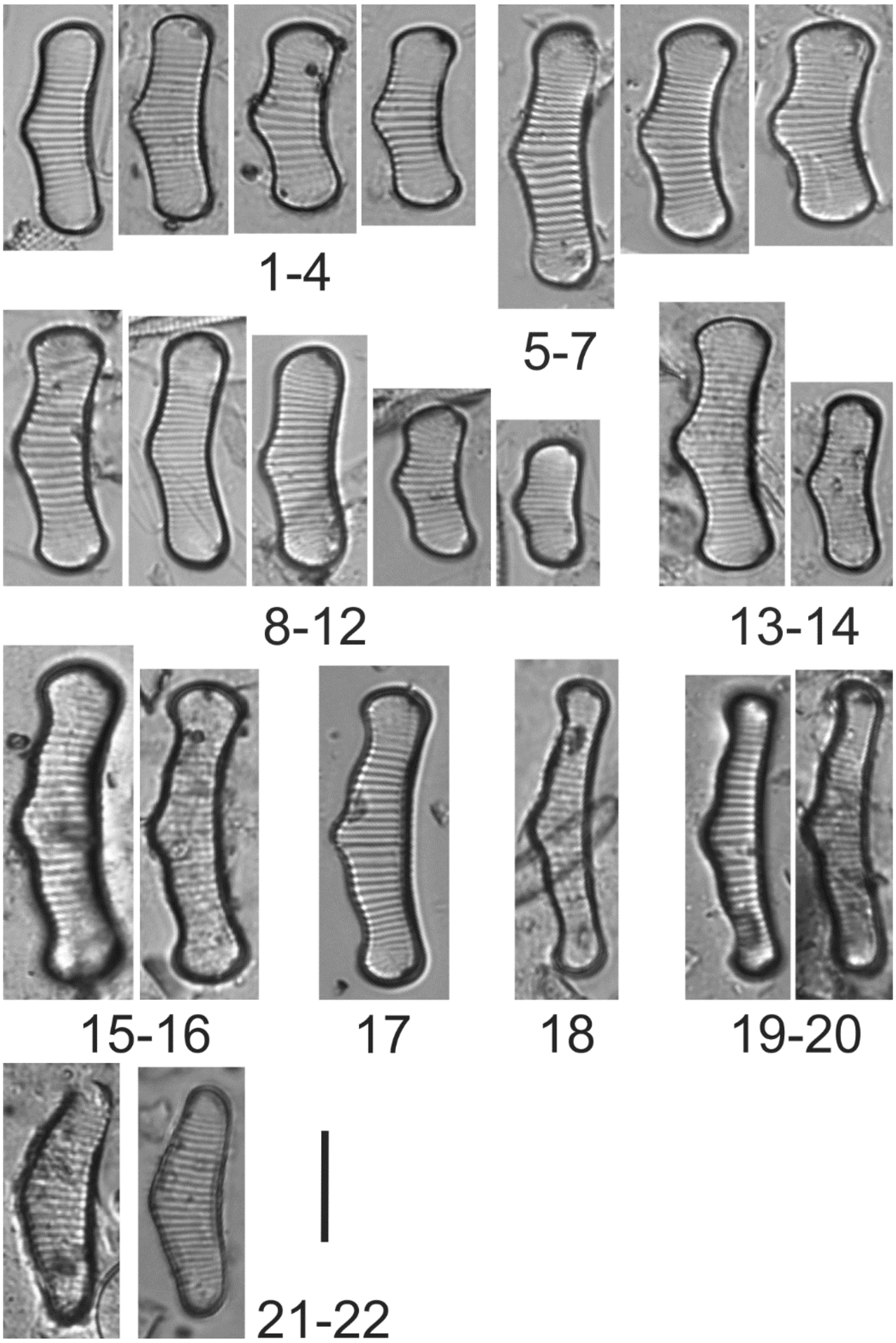

1-4
5-7
8-12
13-14
15-16
17
18
19-20
21-22

Plate 63

Scale Bar = 10 µm: Figs 1, 3; **5 µm**: Fig. 2

Figs 1-3. *Eunotia rabenhorstii* var. *monodon* Cleve & Grunow

Fig. 1. Pedro Beicht reservoir, surface sediment. (SP427581)

Fig. 2. Hedberg reservoir, periphyton. (SP469534)

Fig. 3. Paraitinga reservoir, periphyton. (SP427985)

Fig. 1. Internal valve view.

Figs 2-3. External valve view.

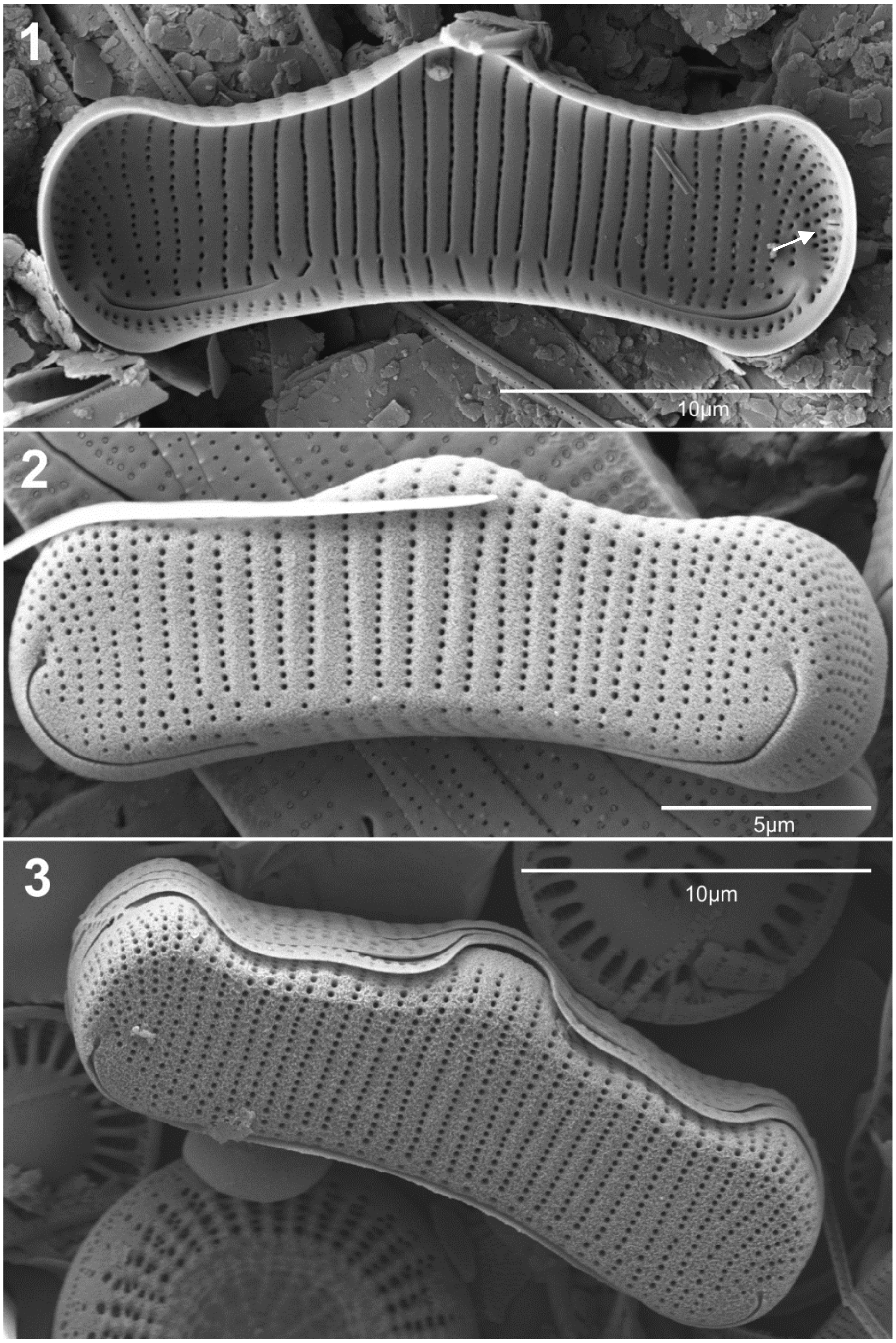

1
10µm
2
5µm
3
10µm

Plate 64

Scale Bar = 10 µm

Figs 1-2. *Eunotia superbidens* Lange-Bertalot

Figs 3-4. *Eunotia* sp. 10

Figs 5-9. *Eunotia bidens* Ehrenberg

Figs 1-2. Cabuçu reservoir, surface sediment. (SP428923)

Figs 3, 5-6. Hedberg reservoir, phytoplankton. (SP469511)

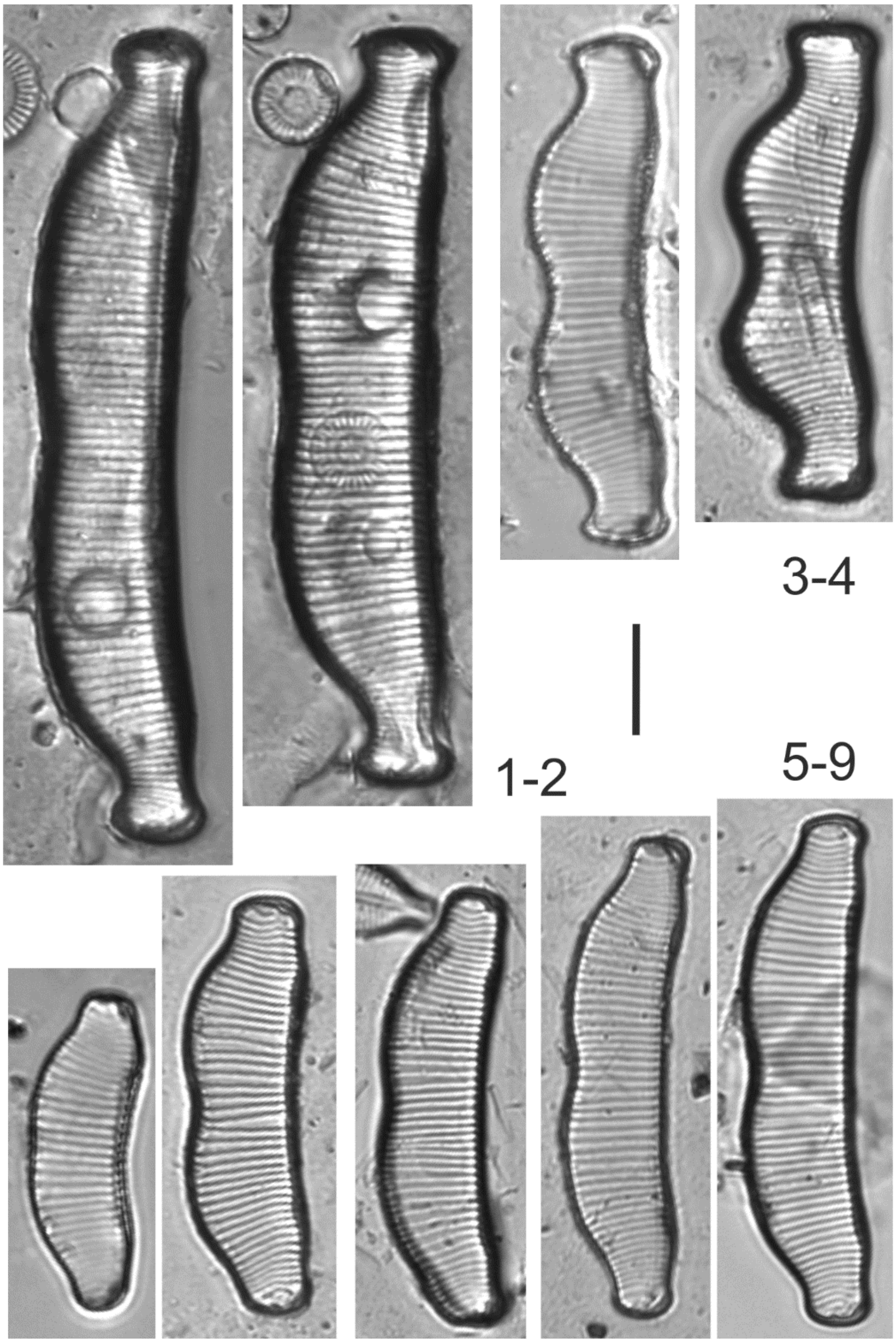
Figs 4, 8-9. Taiaçupeba reservoir, surface sediment. (SP468858)

Fig. 7. Jundiaí reservoir, surface sediment. (SP468850)

Figs 1-2. Morphometry: Apical axis 66.9-72.5 µm; Transapical axis 13.4-14 µm; Striae 11 in 10 µm.

Figs 3-4. Morphometry: Apical axis 42.1-45.1 µm; Transapical axis 10.1-12.7 µm; Striae 10-11 in 10 µm.

Figs 5-9. Morphometry: Apical axis 37.3-44.9 µm; Transapical axis 8.7-10.5 µm; Striae 11-13 in 10 µm.



1-2
3-4
5-9

Plate 65

Scale Bar = 10 µm

Fig. 1. ***Eunotia praerupta*** Ehrenberg

Figs 2-4. ***Eunotia superbidens*** Lange-Bertalot

Figs 5-9. ***Eunotia tropico-arcus*** Metzeltin & Lange-Bertalot

Fig. 1. Jundiaí reservoir, surface sediment. (SP468850)

Figs 2-9. Rio Negro.

Fig. 1. Morphometry: Apical axis 58.6 µm; Transapical axis 15.3 µm; Striae 9 in 10 µm.

Figs 2-4. Morphometry: Apical axis 56.9-60.8 µm; Transapical axis 11.7-12.3 µm; Striae 13-14 in 10 µm.

Figs 5-9. Morphometry: Apical axis 49.7-58.4 µm; Transapical axis 7.1-9 µm; Striae 12-14 in 10 µm.

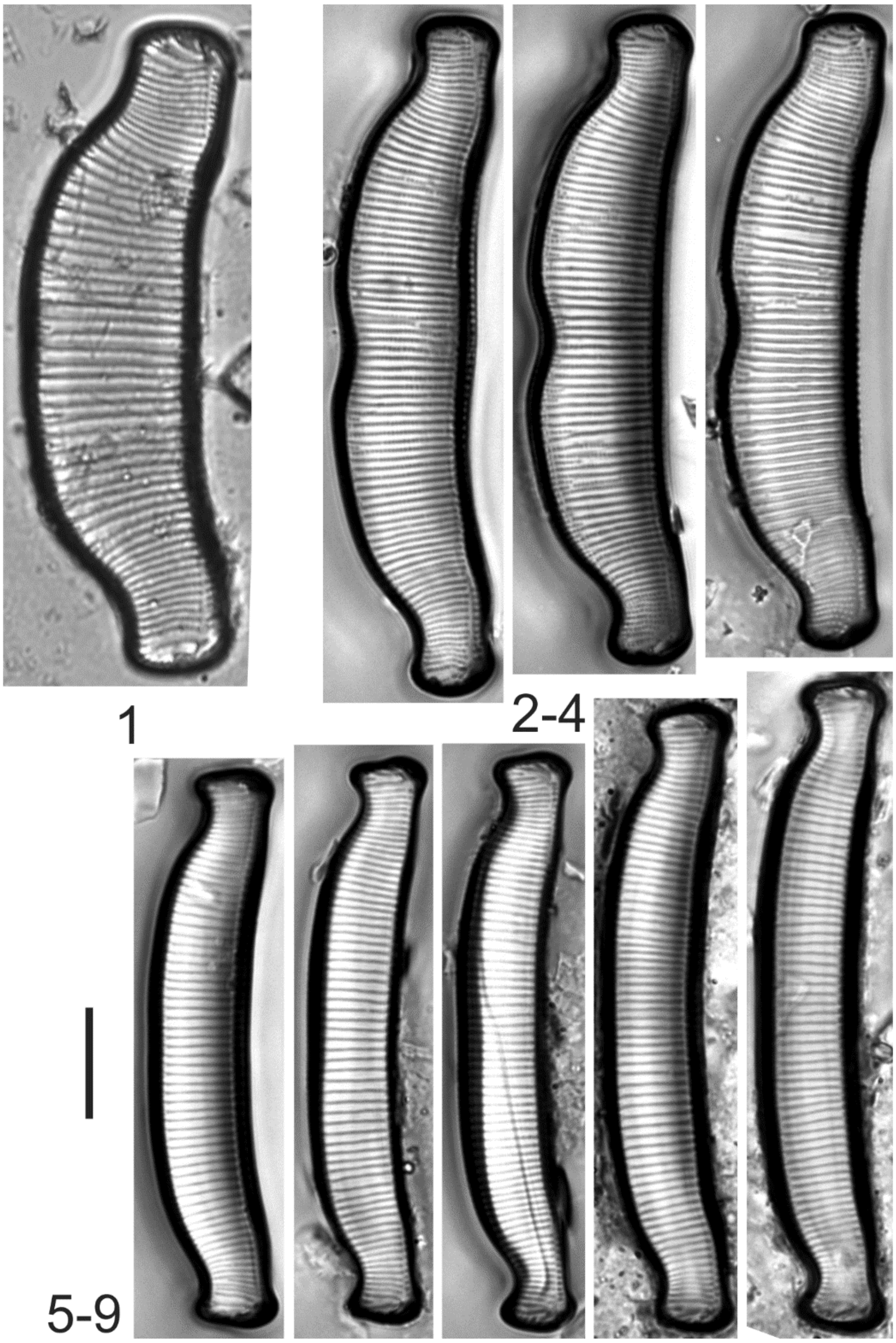

1
2-4
5-9

Plate 66

Scale Bar = 10 µm: Fig. 1; **5 µm**: Figs 2-4

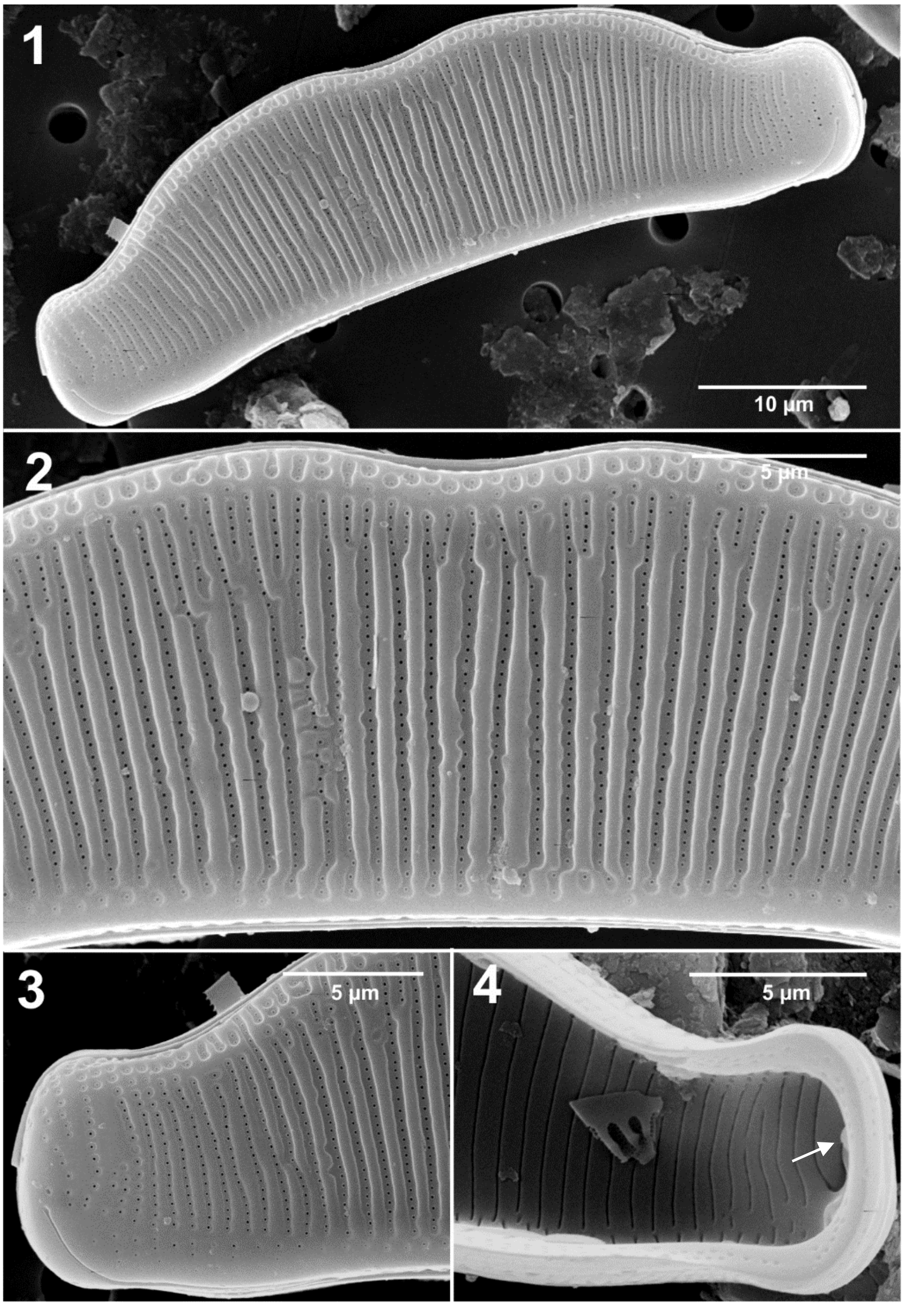
Figs 1-4. ***Eunotia superbidens*** Lange-Bertalot

Figs 1-4. Rio Negro.

Fig. 1. External valve view.

Figs 2-3. External detail of valve view showing striae and raphe.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.



1
10 µm
2
5 µm
3
5 µm
4
5 µm

Plate 67

Scale Bar = 10 µm

Figs 1-6. ***Eunotia papilio*** (Ehrenberg) Grunow

Fig. 7. ***Eunotia trigibba*** Hustedt

Figs 8-9. ***Eunotia*** sp. nov. 9

Figs 10-12. ***Eunotia herzogii*** Krasske

Fig. 13. ***Eunotia schneideri*** Metzeltin & Lange-Bertalot

Figs 1-6. Taiaçupeba reservoir, periphyton. (SP427987)

Fig. 7. Jundiaí reservoir, surface sediment. (SP468850)

Figs 8-12. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Fig. 13. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 1-6. Morphometry: Apical axis 27.8-34.5 µm; Transapical axis 14.8-19.7 µm; Striae 10-13 in 10 µm.

Fig. 7. Morphometry: Apical axis 32.8 µm; Transapical axis 12.3 µm; Striae 9 in 10 µm.

Figs 8-9. Morphometry: Apical axis 29.9-33.1 µm; Transapical axis 6.9-7.3 µm; Striae 11-12 in 10 µm.

Figs 10-12. Morphometry: Apical axis 20.6-31.3 µm; Transapical axis 4.1-5.1 µm; Striae 13-16 in 10 µm.

Fig. 13. Morphometry: Apical axis 24.9 µm; Transapical axis 5 µm; Striae 15 in 10 µm.

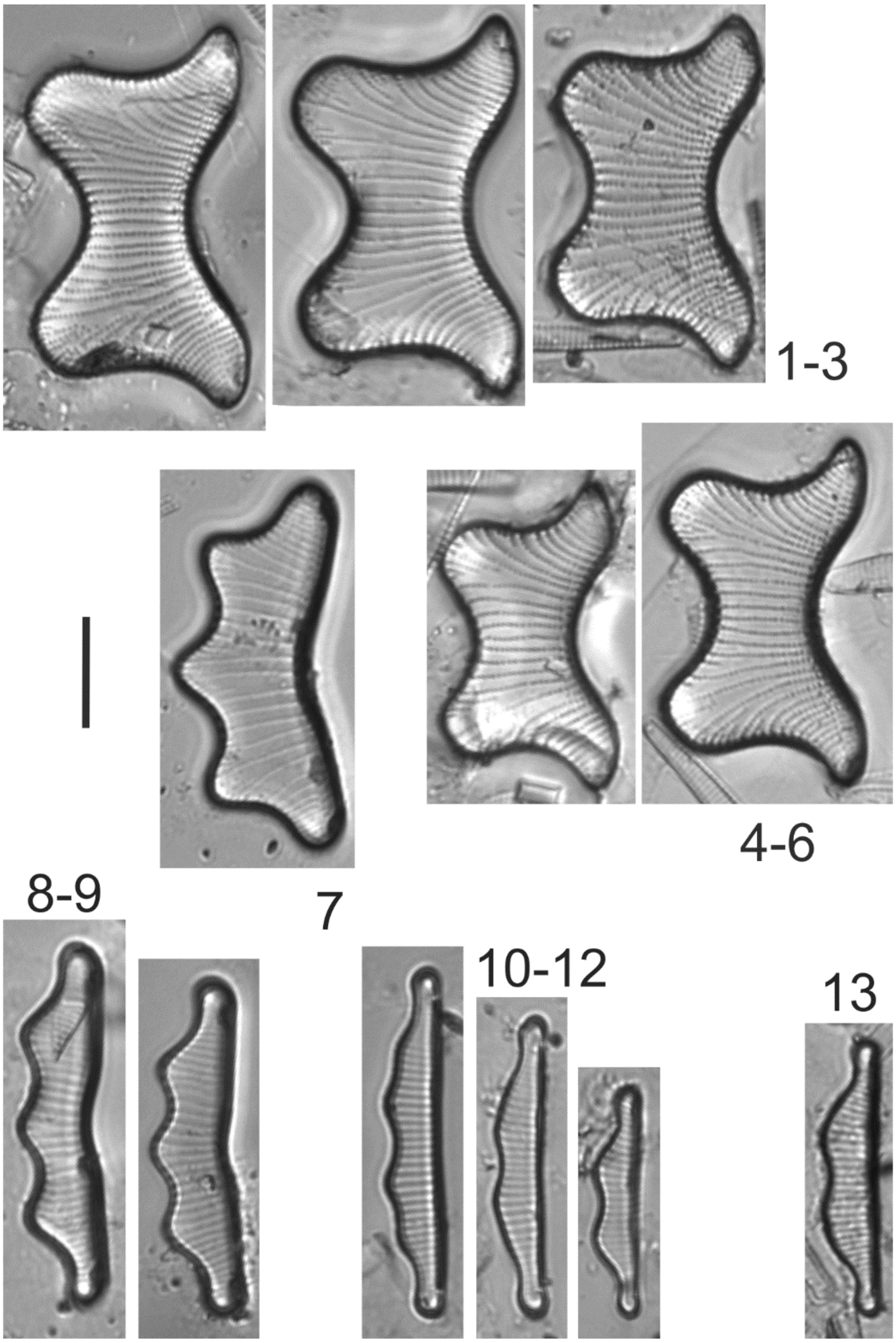

1-3
4-6
7
8-9
10-12
13

Plate 68

Scale Bar = 10 µm: Figs 1-2, 4; **5 µm**: Figs 3, 5

Figs 1-3. *Eunotia papilio* (Ehrenberg) Grunow

Figs 4-5. *Eunotia trigibba* Hustedt

Figs 1-3. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 4-5. Pedro Beicht reservoir, phytoplankton. (SP427595)

Figs 1, 4. External valve view.

Fig. 2. Internal valve view.

Figs 3, 5. Internal detail of valve view showing helictoglossae and rimoportula.

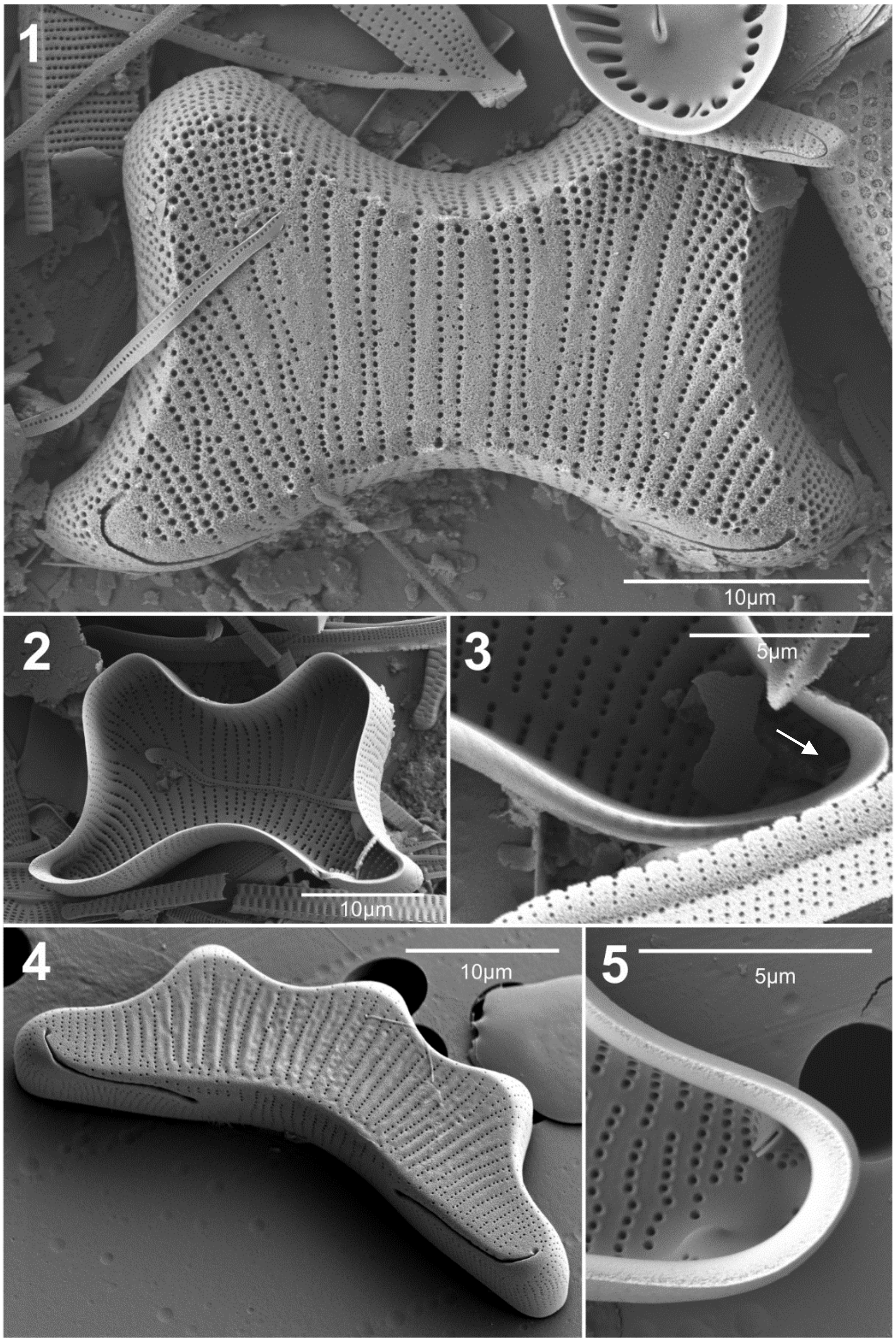

1
10µm
2
10µm
3
5µm
4
10µm
5
5µm

Plate 69

Scale Bar = 10 µm

Figs 1-5. ***Eunotia tridentula*** Ehrenberg

Figs 6-13. ***Eunotia tecta*** Krasske

Figs 1-5. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 6-8. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 9-13. Ribeirão do Campo reservoir, periphyton. (SP427928)

Figs 1-5. Morphometry: Apical axis 24.3-57.7 µm; Transapical axis 7.2-8.2 µm; Striae 11-14 in 10 µm.

Figs 6-13. Morphometry: Apical axis 20.6-41.1 µm; Transapical axis 6.9-8.4 µm; Striae 14-17 in 10 µm.

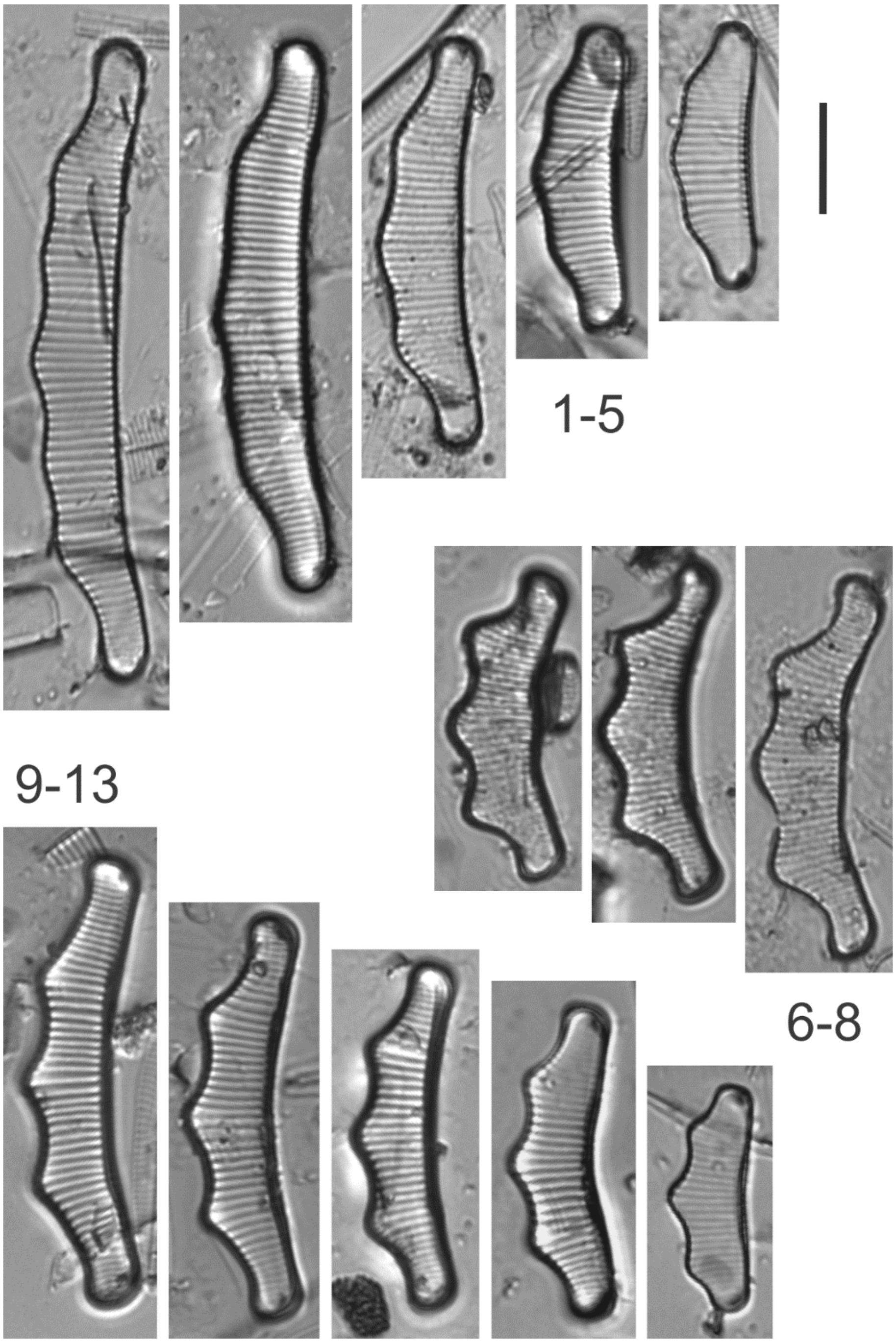

1-5
9-13
6-8

Plate 70

Scale Bar = 20 µm: Fig. 3; **10 µm**: Figs 1-2, 4-6

Figs 1-3. *Eunotia tridentula* Ehrenberg

Figs 4-6. *Eunotia tecta* Krasske

Figs 1, 3-6. Pedro Beicht reservoir, surface sediment. (SP427580)

Fig. 2. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 1, 4. Internal valve view.

Figs 2-3, 6. External valve view.

Fig. 5. Valve in girdle view.

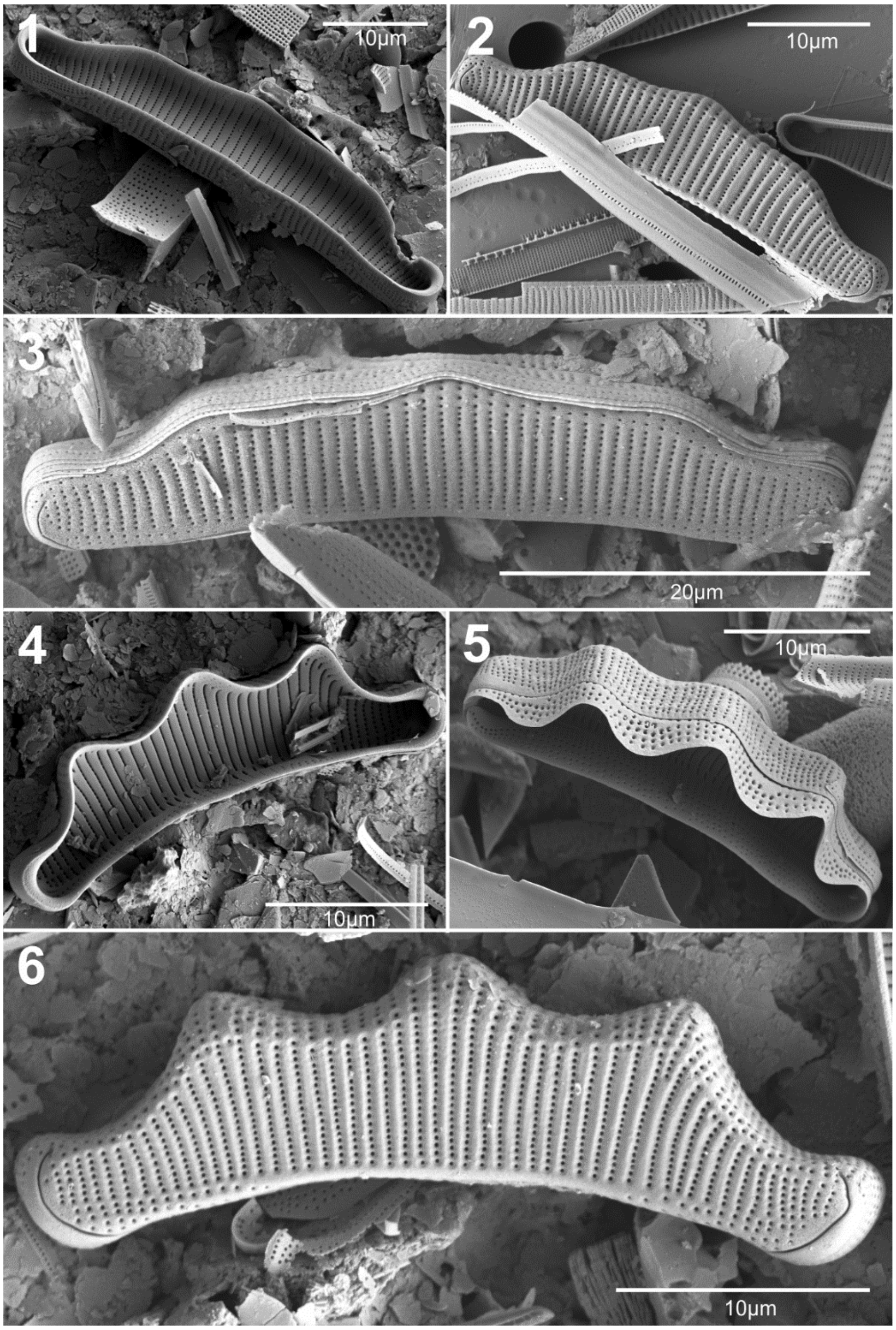

1
10µm
2
10µm
3
20µm
4
10µm
5
10µm
6
10µm

Plate 71

Scale Bar = 10 µm

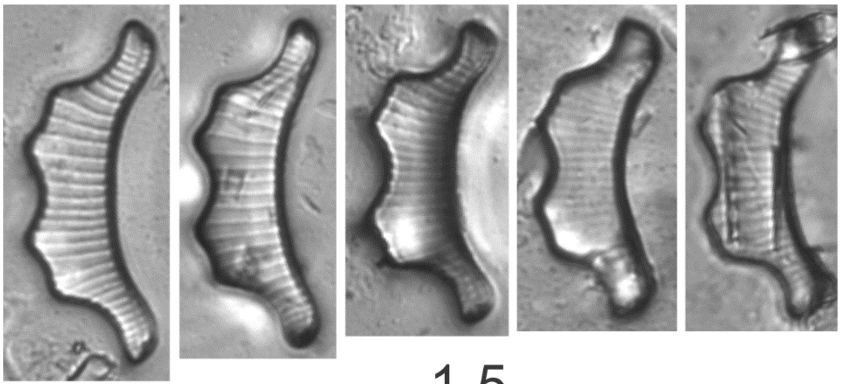
Figs 1-14. ***Eunotia camelus*** Ehrenberg

Figs 1-5. Pedro Beicht reservoir, phytoplankton. (SP427595)

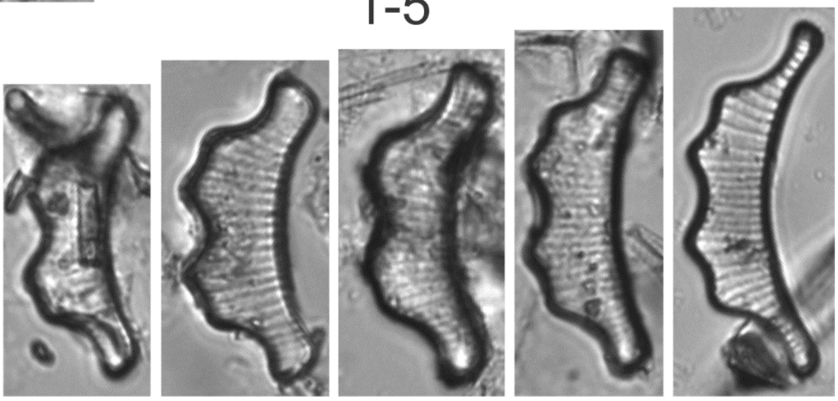
Figs 6-10. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 11-14. Guarapiranga reservoir, surface sediment. (SP428507)

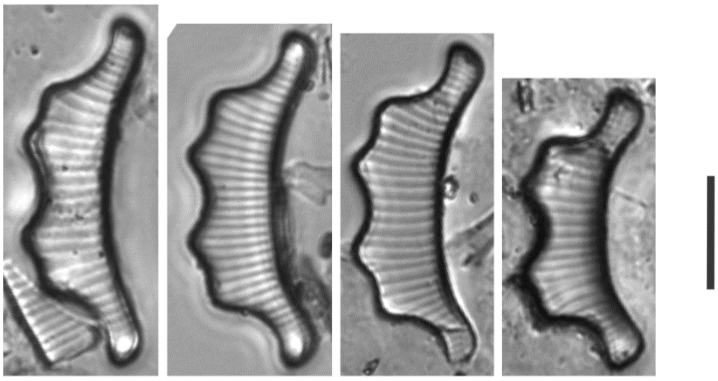
Figs 1-14. Morphometry: Apical axis 24.2-30.8 µm; Transapical axis 7.3-9.5 µm; Striae 10-14 in 10 µm.



1-5



6-10



11-14

Plate 72

Scale Bar = 10 µm: Figs 1-3, 5; **4 µm**: Fig. 4

Figs 1-5. *Eunotia camelus* Ehrenberg

Figs 1-5. Pedro Beicht reservoir, surface sediment. (SP427580)

Figs 1-2. External valve view.

Fig. 3. Internal valve view.

Fig. 4. External detail of valve view showing raphe and rimoportula.

Fig. 5. Frustule in girdle view.

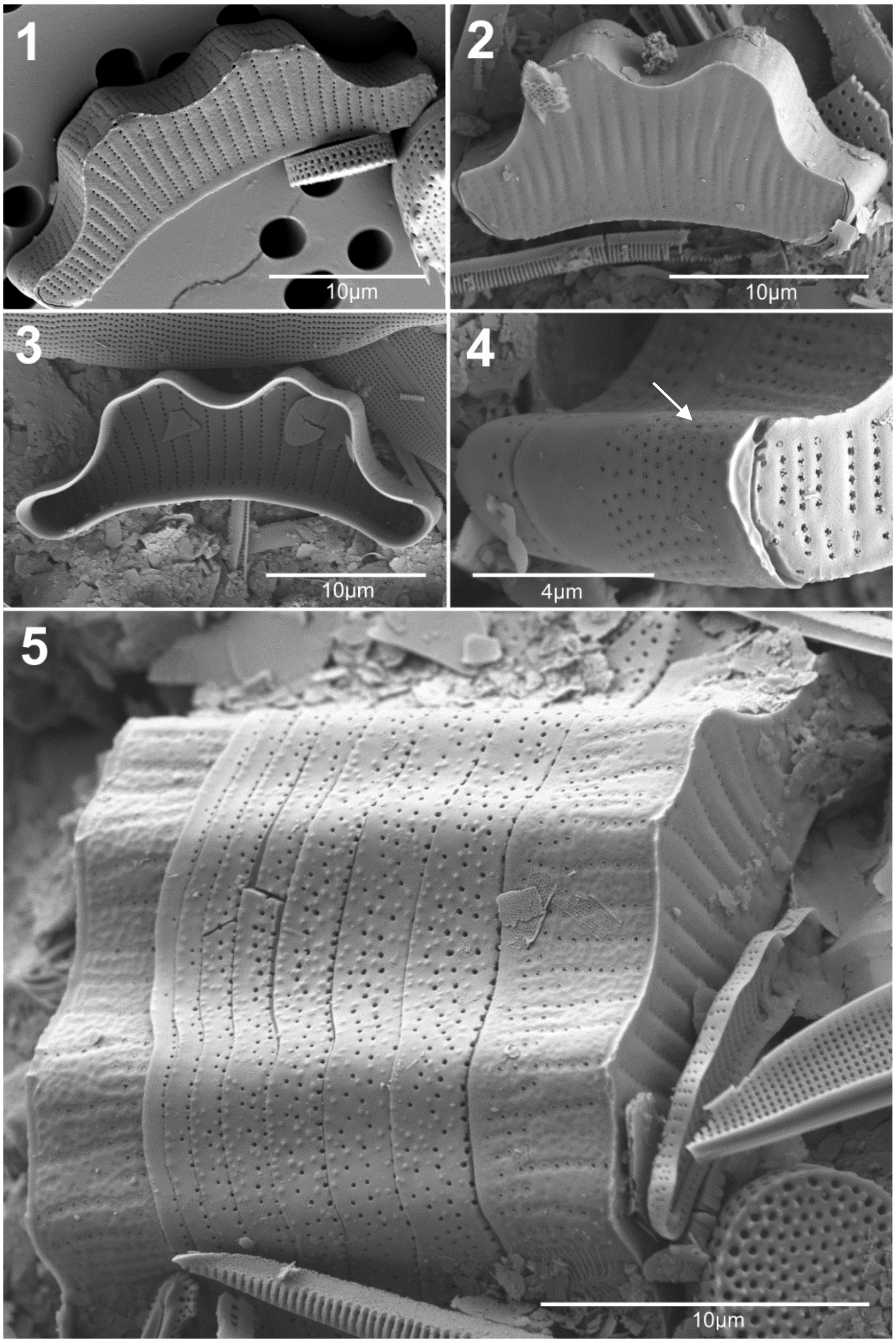

1
10μm
2
10μm
3
10μm
4
4μm
5
10μm

Plate 73

Scale Bar = 10 µm

Figs 1-17. *Eunotia* sp. nov. 10

Figs 1-11. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 12-17. Tanque Grande reservoir, periphyton. (SP428935)

Figs 1-17. Morphometry: Apical axis 15.1-59 µm; Transapical axis 5.1-8.1 µm; Striae 11-15 in 10 µm.

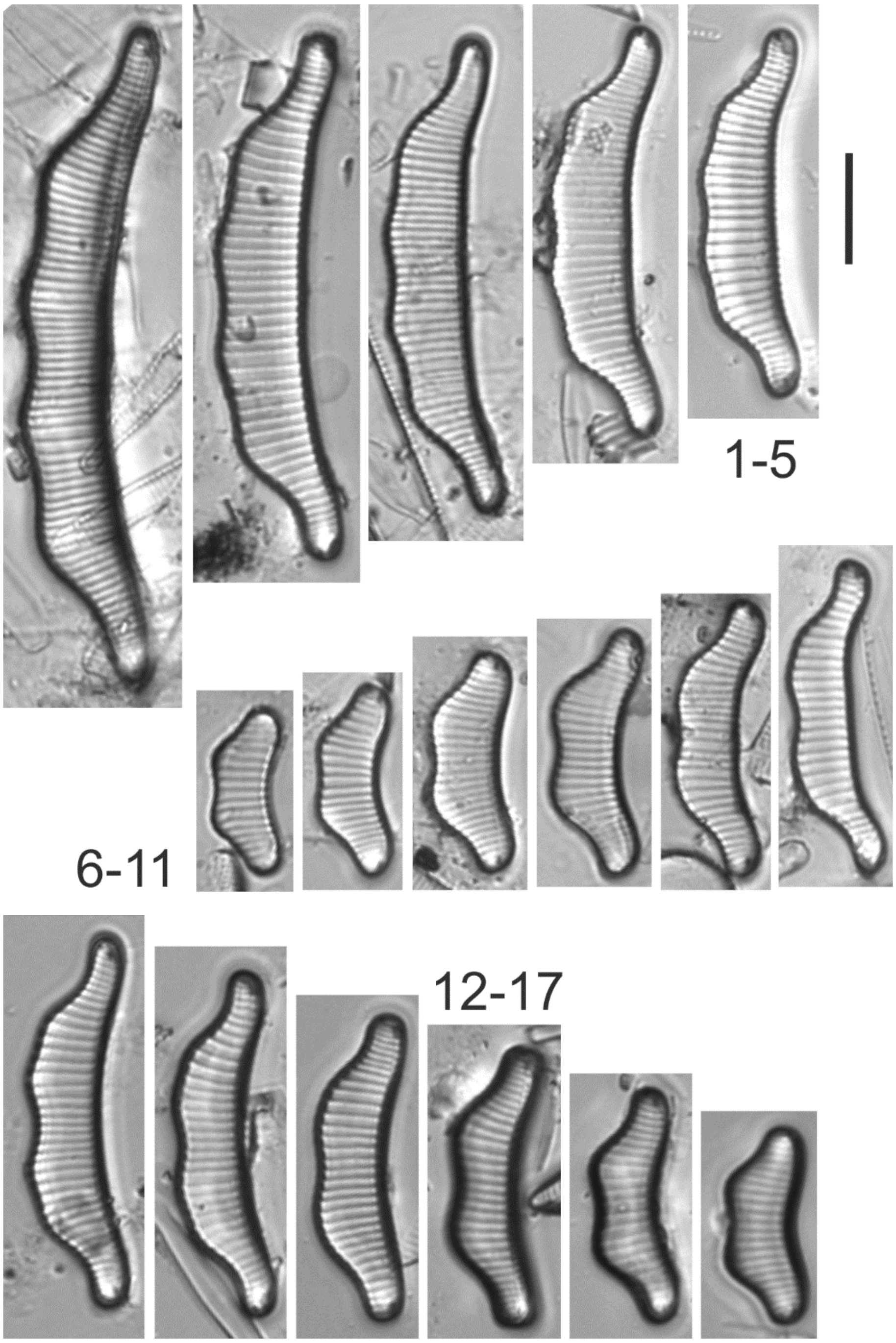

1-5
6-11
12-17

Plate 74

Scale Bar = 10 µm

Figs 1-8. ***Eunotia*** sp. nov. 10

Fig. 9. ***Eunotia bicornigera*** Metzeltin & Lange-Bertalot

Figs 10-15. ***Eunotia cameliopsis*** Metzeltin & Lange-Bertalot

Figs 1-6. Ponte Nova reservoir, periphyton. (SP427983)

Figs 7-8. Paiva Castro reservoir, periphyton. (SP469369)

Fig. 9. Taiaçupeba reservoir, surface sediment. (SP468858)

Figs 10-15. Rio Negro.

Figs 1-8. Morphometry: Apical axis 26-55.4 µm; Transapical axis 6.4-7.5 µm; Striae 10-14 in 10 µm.

Fig. 9. Morphometry: Apical axis 27.9 µm; Transapical axis 7.1 µm; Striae 15 in 10 µm.

Figs 10-15. Morphometry: Apical axis 27-68.1 µm; Transapical axis 8.8-11.6 µm; Striae 14-16 in 10 µm.

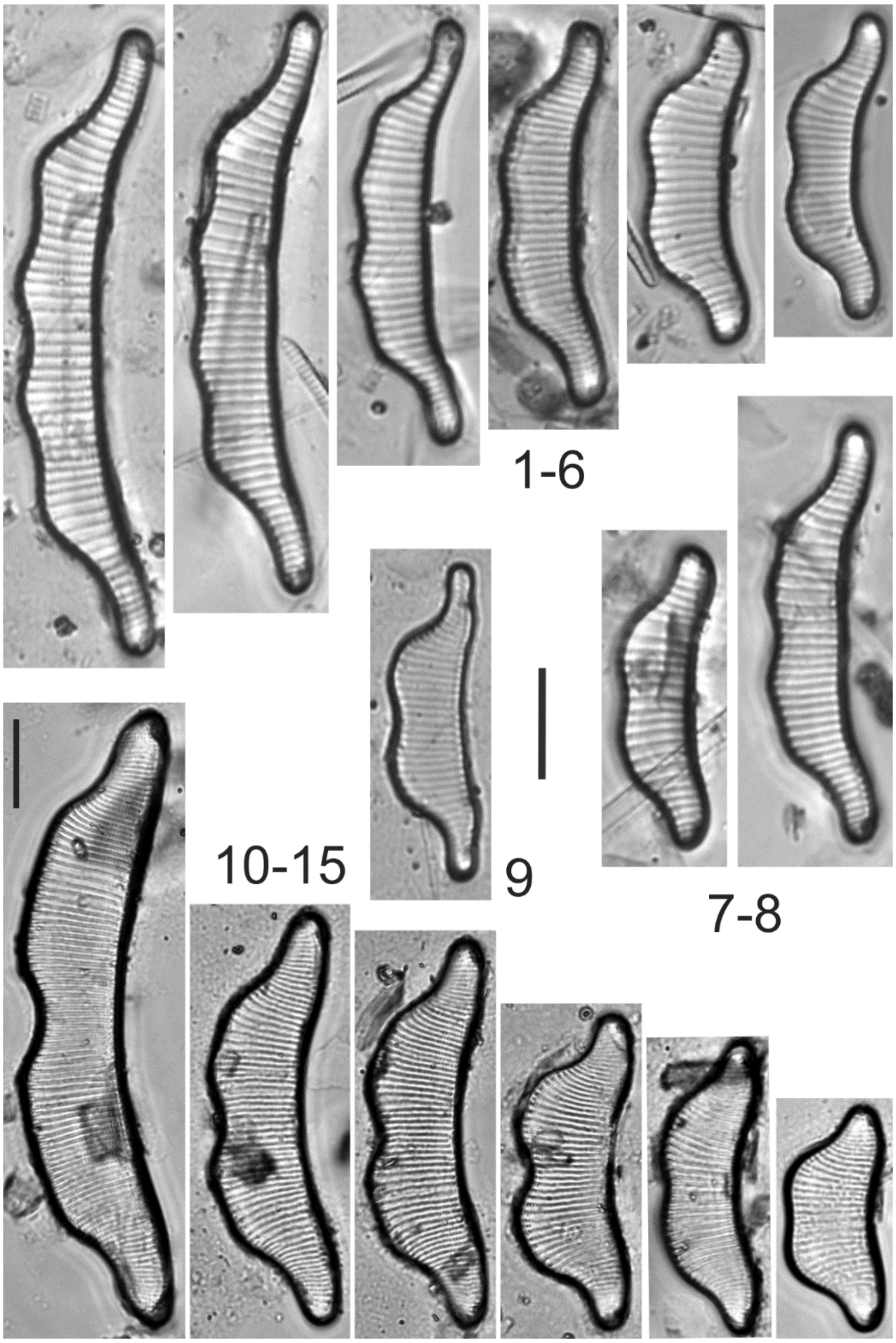

1-6
9
7-8
10-15

Plate 75

Scale Bar = 20 µm: Figs 1-2; **10 µm**: Fig. 3; **5 µm**: Fig. 4; **4 µm**: Fig. 5

Figs 1-5. ***Eunotia*** sp. nov. 10

Figs 1-5. Paiva Castro reservoir, periphyton. (SP469369)

Figs 1-2. External valve view.

Fig. 3. Internal valve view.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

Fig. 5. External detail of valve view showing raphe and rimoportula.

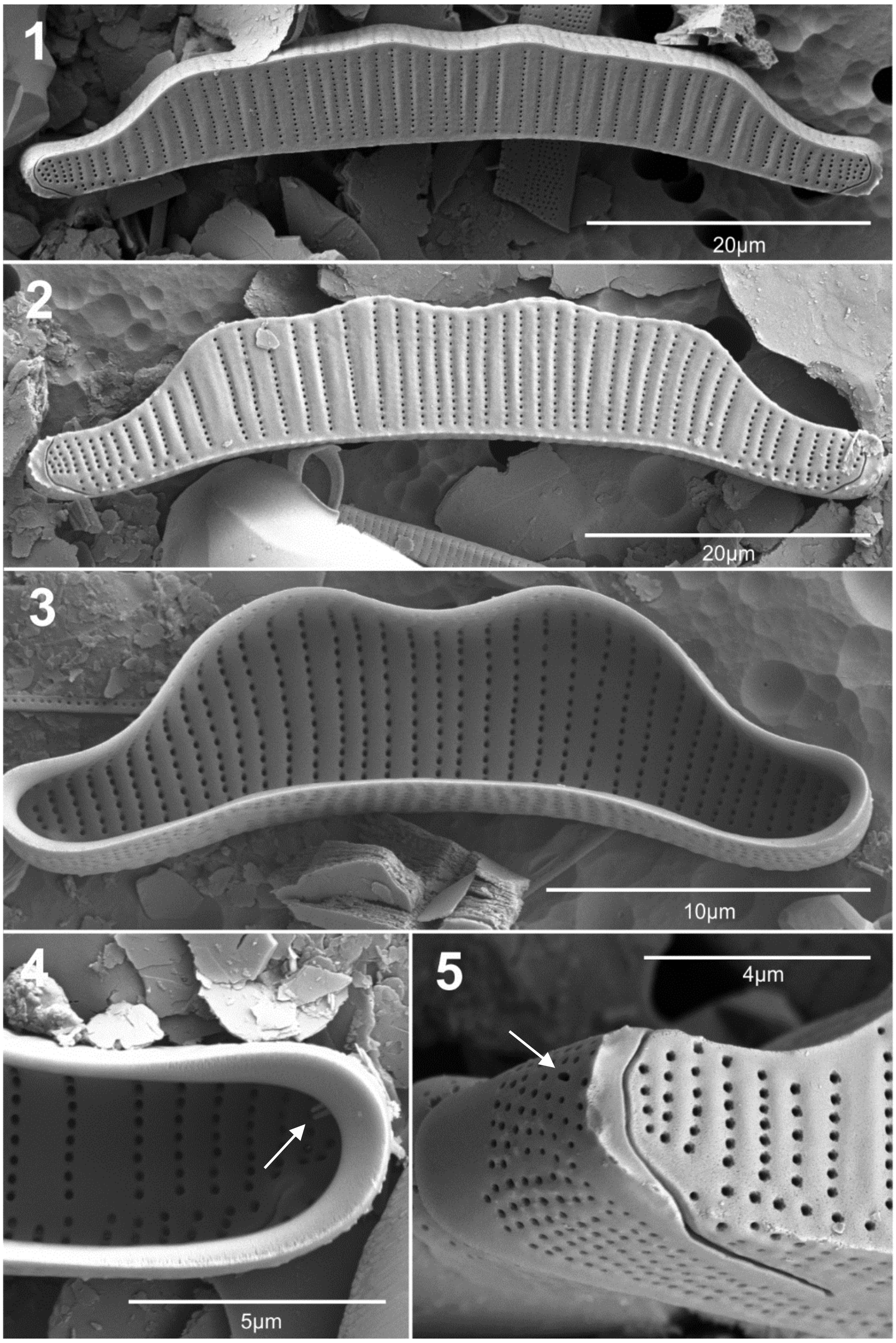

1
20μm
2
20μm
3
10μm
4
5μm
5
4μm

Plate 76

Scale Bar = 20 µm: Fig. 3; **10 µm**: Figs 1, 4; **2 µm**: Fig. 2

Figs 1-4. *Eunotia* sp. nov. 10

Figs 1-4. Guarapiranga reservoir, surface sediment. (SP428507)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing striae.

Figs 3-4. Frustules in girdle view

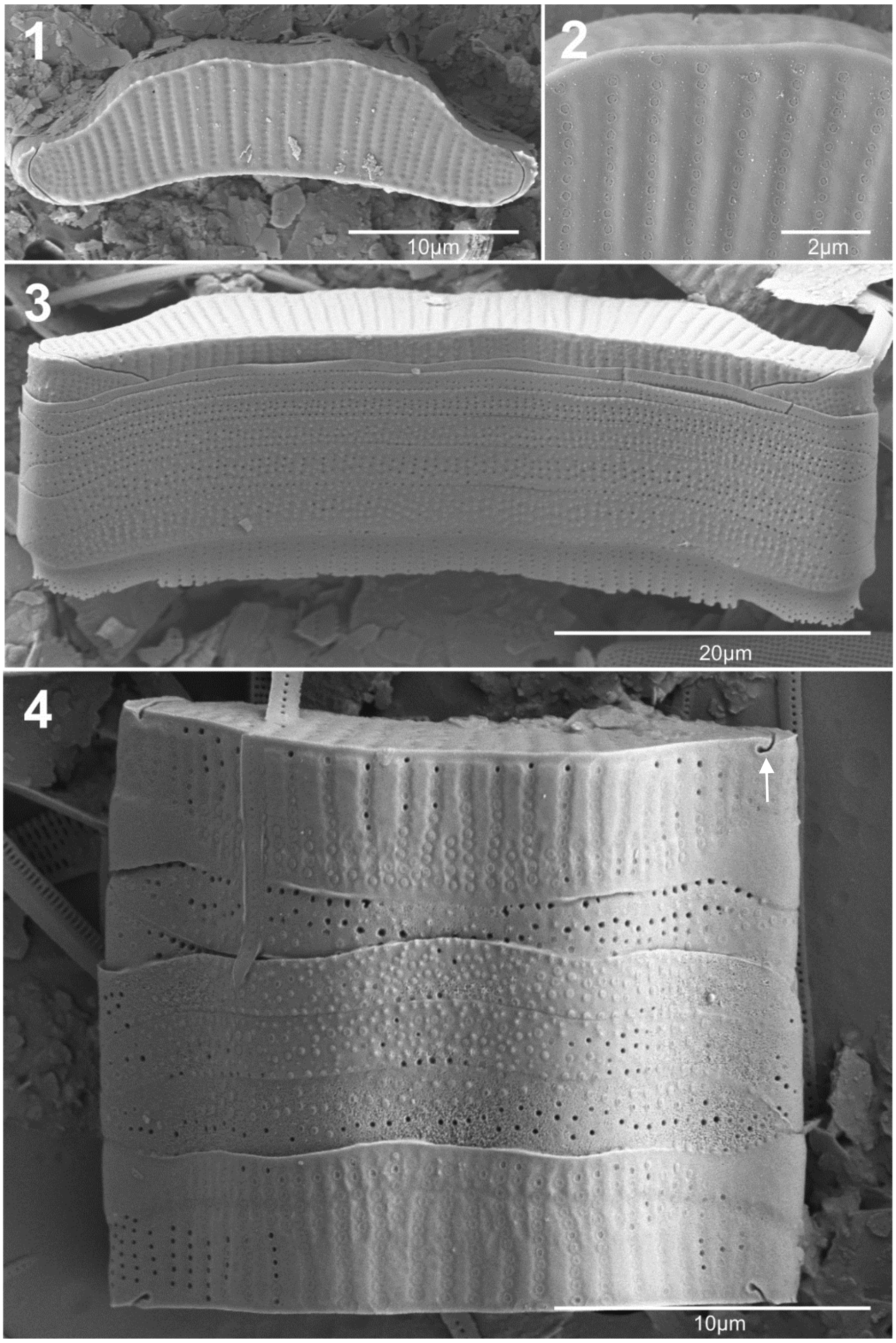

1
10µm
2
2µm
3
20µm
4
10µm

Plate 77

Scale Bar = 10 µm

Figs 1-7. ***Eunotia georgii*** Metzeltin & Lange-Bertalot

Figs 8-9. ***Eunotia*** sp. nov. 11

Fig. 1. Pedro Beicht reservoir, phytoplankton. (SP427595)

Fig. 2. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 3, 8-9. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 4-5. Ribeirão do Campo reservoir, surface sediment. (SP468841)

Fig. 6. Ribeirão do Campo reservoir, periphyton. (SP427928)

Fig. 7. Ribeirão do Campo reservoir, periphyton. (SP427982)

Figs 1-7. Morphometry: Apical axis 47.6-75.8 µm; Transapical axis 7.1-11 µm; Striae 11-14 in 10 µm.

Figs 8-9. Morphometry: Apical axis 59.6-88.2 µm; Transapical axis 16.2-19.4 µm; Striae 7 in 10 µm.

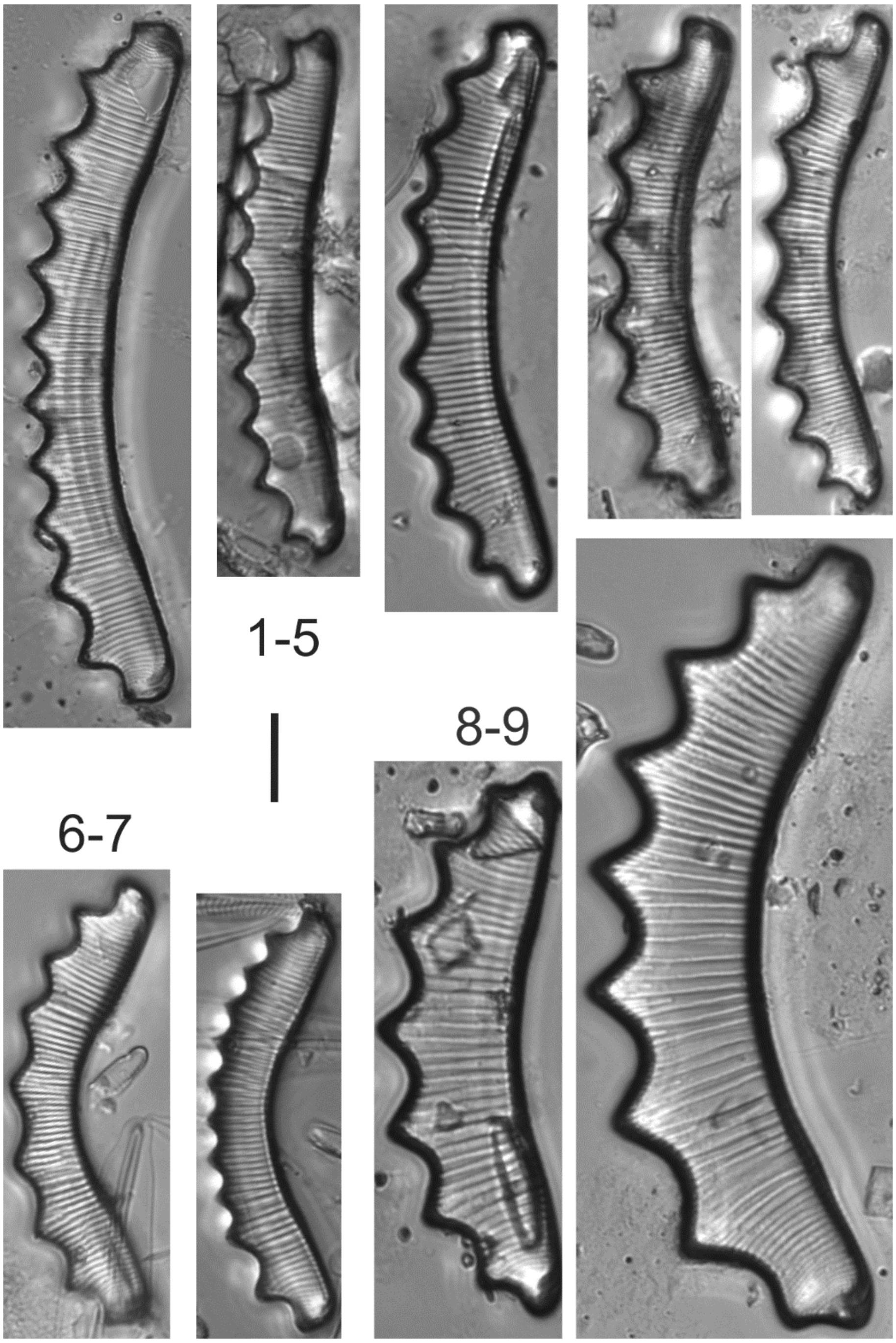

1-5
6-7
8-9

Plate 78

Scale Bar = 10 µm: Fig. 1; **5 µm**: Figs 2-3

Figs 1-3. ***Eunotia muelleri*** Hustedt

Figs 1-3. Type material.

Fig. 1. Internal valve view.

Figs 2-3. Internal detail of valve view showing raphe and rimoportula.

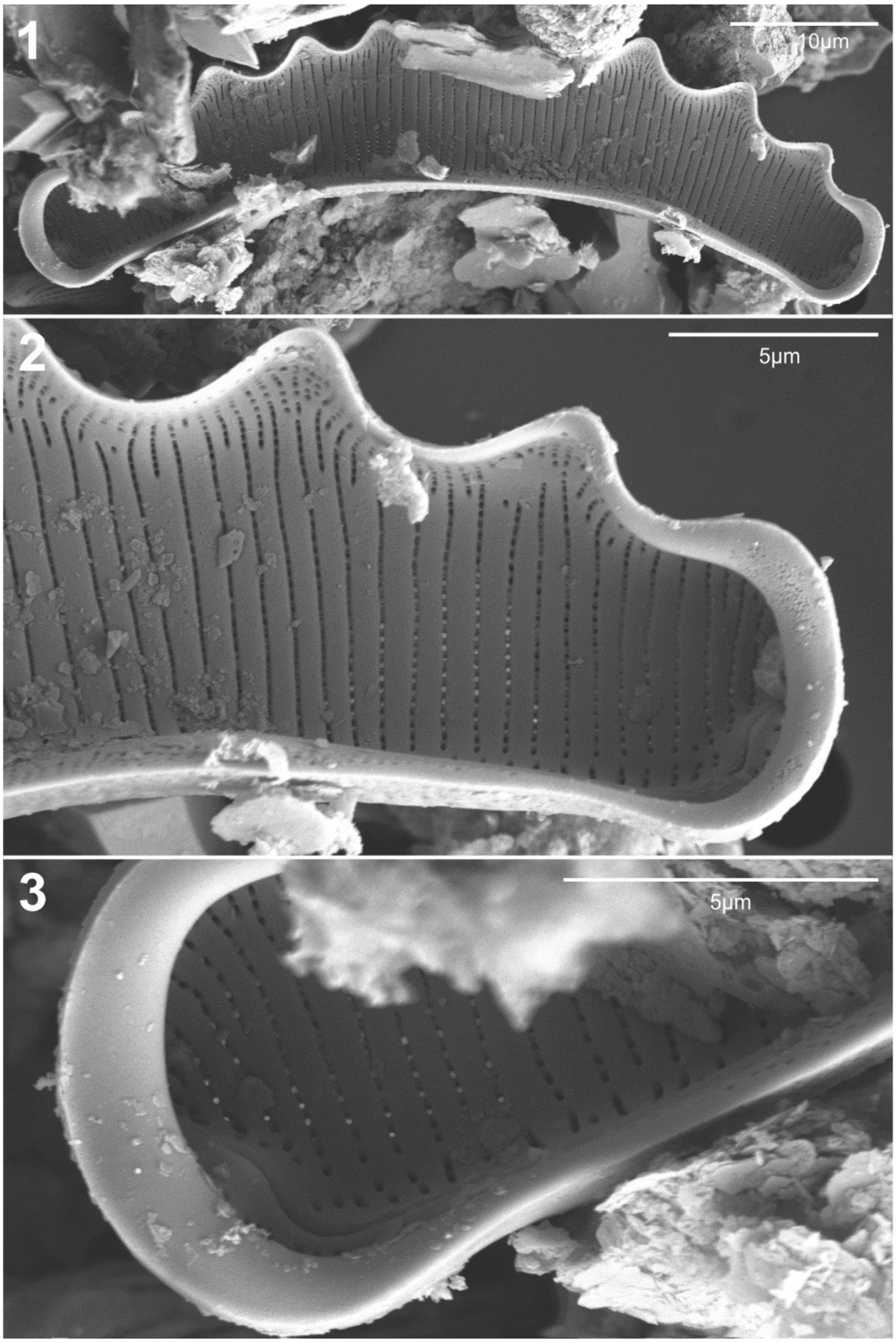

1
10µm
2
5µm
3
5µm

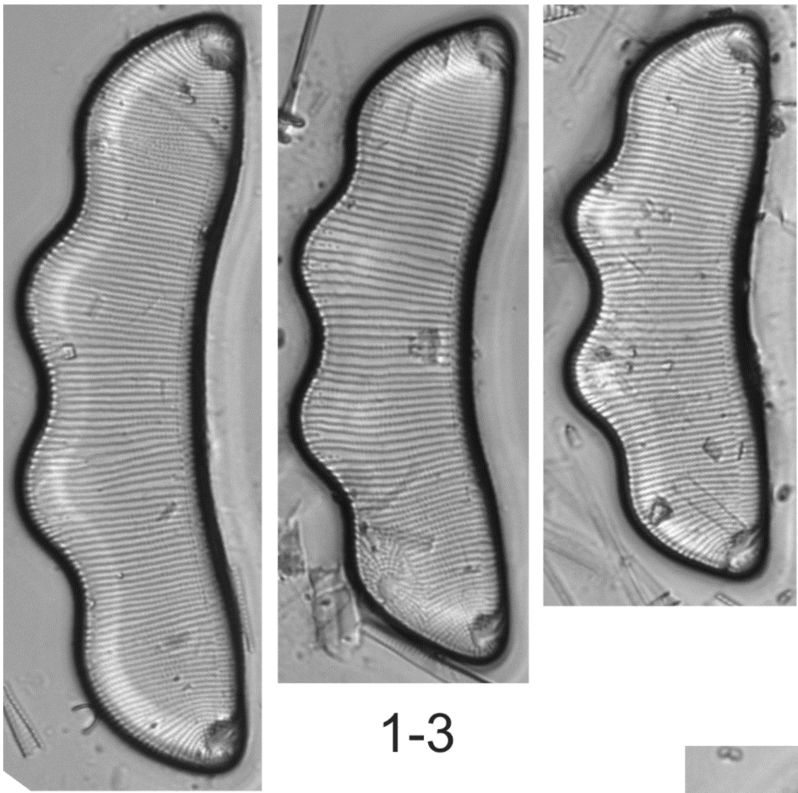
Plate 79

Scale Bar = 10 µm

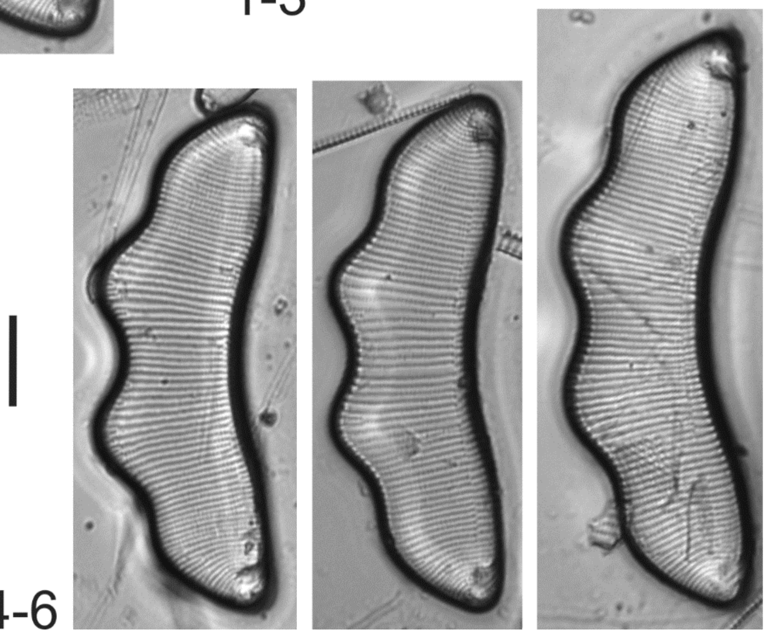
Figs 1-6. *Eunotia yanomami* Metzeltin & Lange-Bertalot

Figs 1-6. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-6. Morphometry: Apical axis 55.6-83.1 µm; Transapical axis 12-16.7 µm; Striae 11-13 in 10 µm.



1-3



4-6

Plate 80

Scale Bar = 10 µm

Figs 1-9. *Eunotia zygodon* var. *zygodon* Ehrenberg

Figs 1-4. Pedro Beicht reservoir, phytoplankton. (SP427595)

Figs 5-9. Guarapiranga reservoir, surface sediment. (SP428507)

Figs 1-9. Morphometry: Apical axis 64.4-119.7 µm; Transapical axis 11.3-16.3 µm; Striae 10-17 in 10 µm.

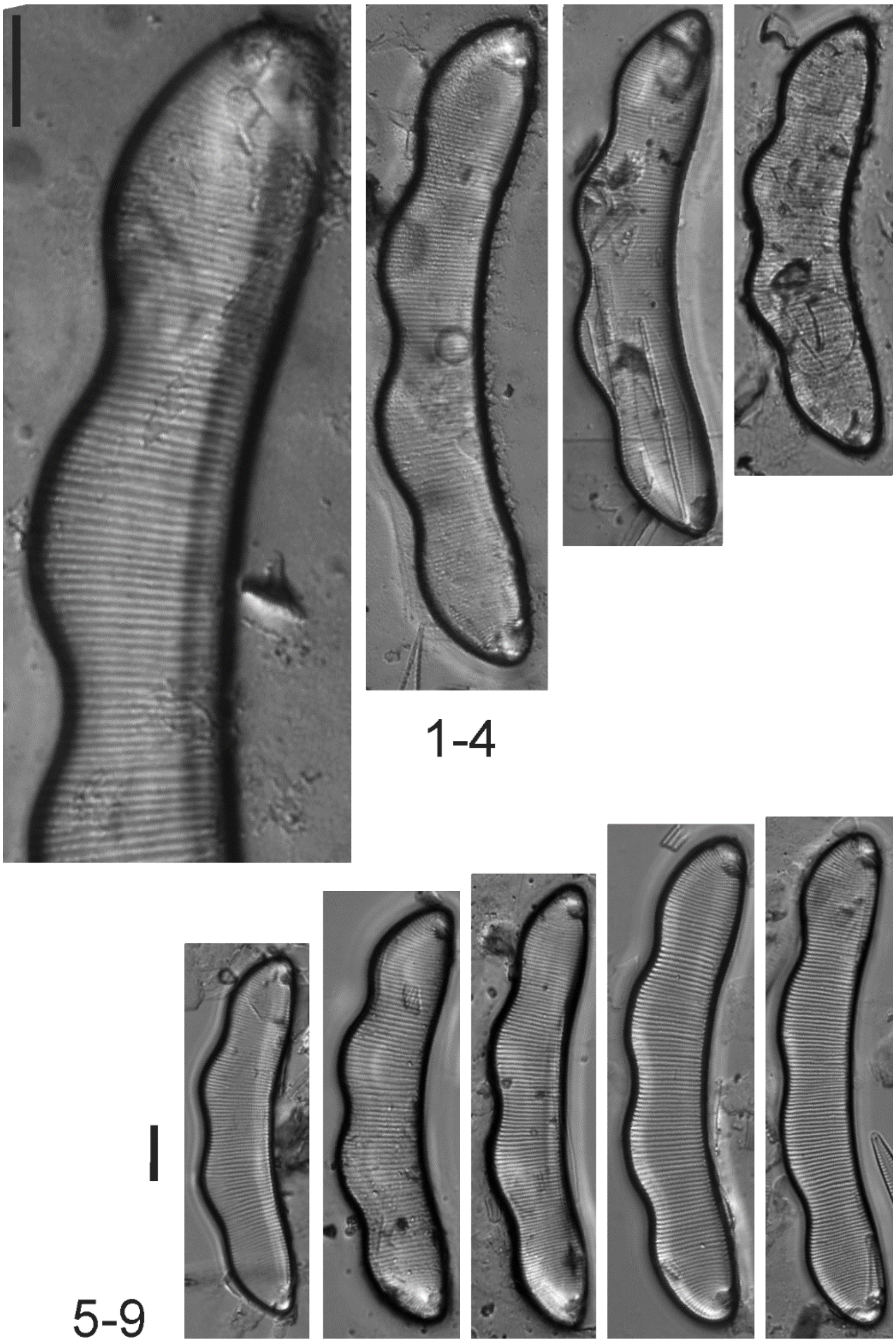

1-4
5-9

Plate 81

Scale Bar = 10 µm

Fig. 1. ***Eunotia yanomami*** Metzeltin & Lange-Bertalot

Fig. 2. ***Eunotia zygodon*** Ehrenberg

Figs 3-5. ***Eunotia zygodon*** **var.** ***gracilis*** Hustedt

Figs 1, 3-4. Ponte Nova reservoir, periphyton. (SP427983)

Fig. 2. Pedro Beicht reservoir, phytoplankton. (SP427595)

Fig. 5. Ponte Nova reservoir, surface sediment. (SP468846)

Fig. 1. Morphometry: Apical axis 150.8 µm; Transapical axis 10.6 µm; Striae 14 in 10 µm.

Fig. 2. Morphometry: Apical axis 91.1 µm; Transapical axis 12.4 µm; Striae 13 in 10 µm.

Figs 3-5. Morphometry: Apical axis 32.2-50.1 µm; Transapical axis 6.5-8.4 µm; Striae 13-16 in 10 µm.

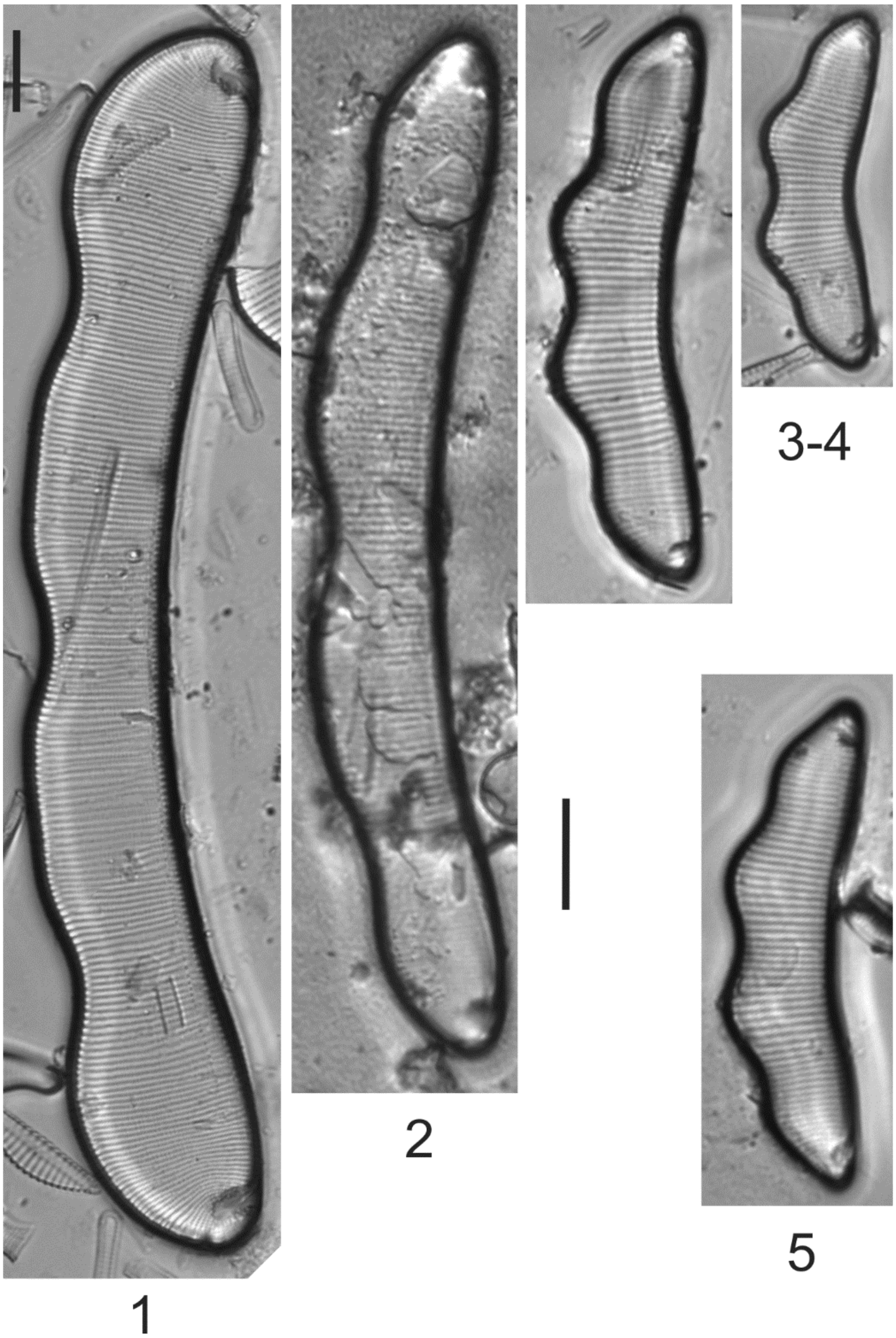

1
2
3-4
5

Plate 82

Scale Bar = 40 µm: Fig. 1; **5 µm**: Fig. 2

Fig. 1. *Eunotia zygodon* var. *zygodon* Ehrenberg

Fig. 2. *Eunotia yanomami* Metzeltin & Lange-Bertalot

Fig. 1. Pedro Beicht reservoir, phytoplankton. (SP427595)

Fig. 2. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-2. External valve view.

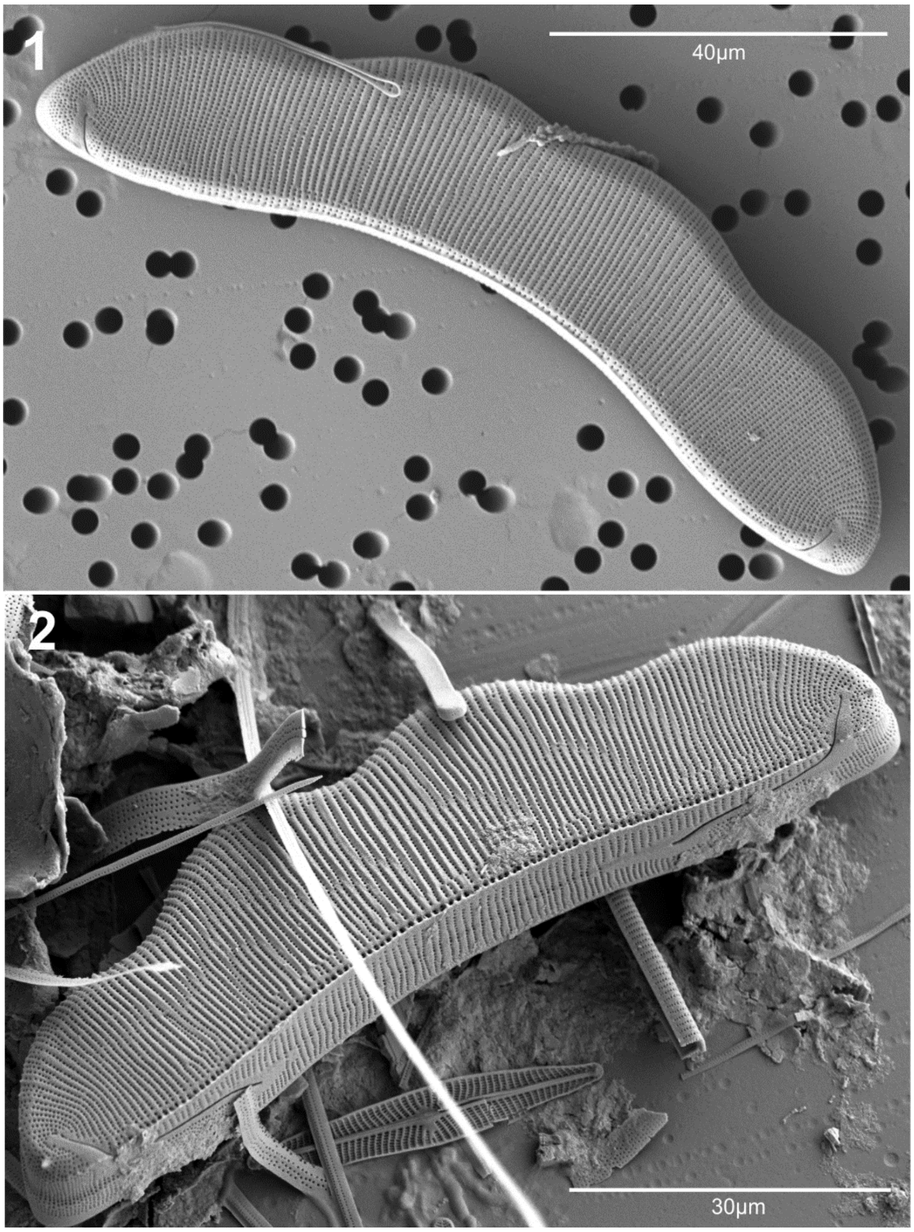

1
40µm
2
30µm

Plate 83

Scale Bar = 20 µm: Figs 1-2; **5 µm**: Fig. 3

Figs 1-3. *Eunotia zygodon* var. *zygodon* Ehrenberg

Figs 1-3. Guarapiranga reservoir, surface sediment. (SP428507)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. Internal detail of valve view showing helictoglossae and rimoportula.

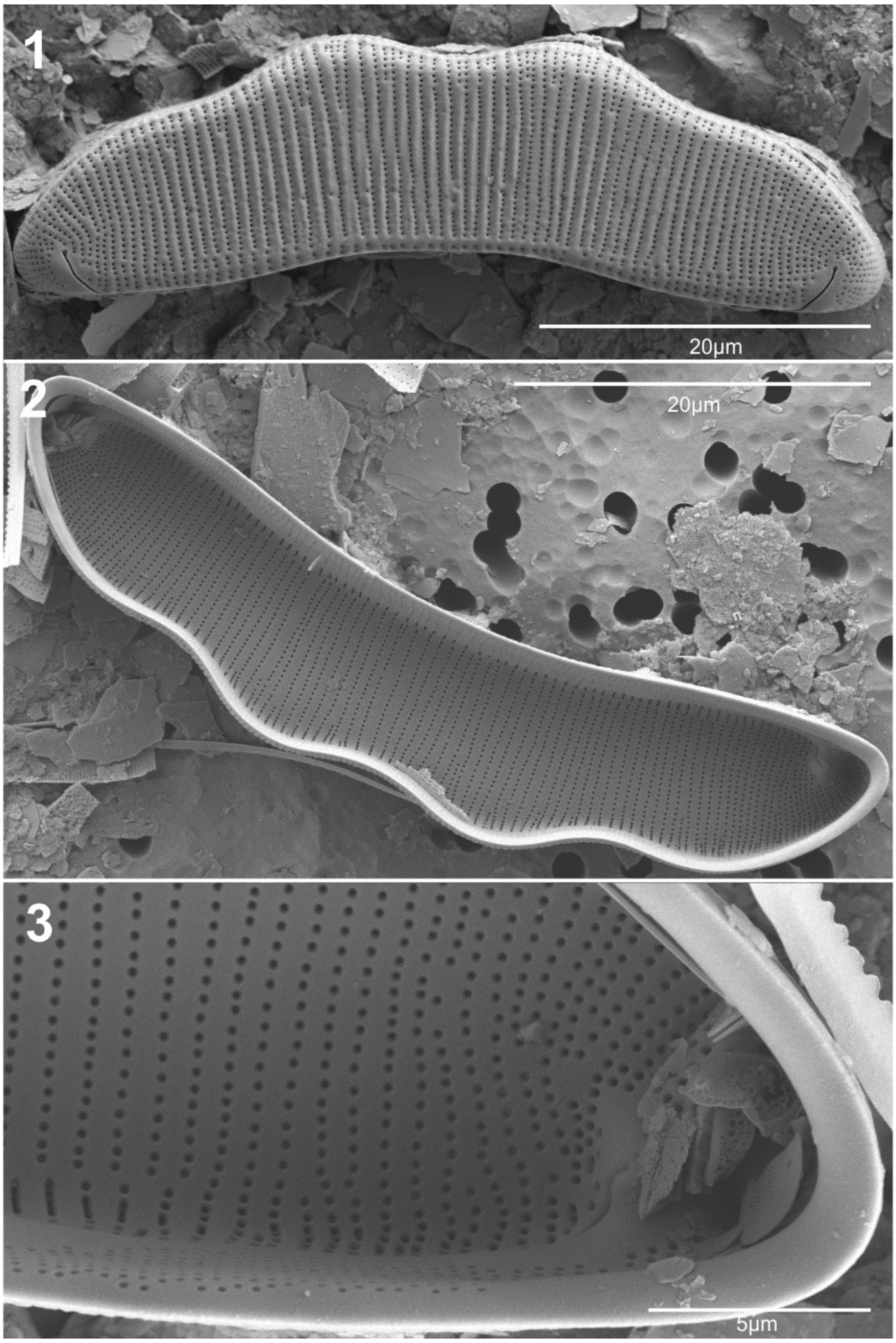

1
20µm
2
20µm
3
5µm

Plate 84

Scale Bar = 50 µm: Fig. 2; **30 µm**: Fig. 1; **5 µm**: Fig. 3

Figs 1-3. *Eunotia zygodon* var. *zygodon* Ehrenberg

Figs 1-3. Guarapiranga reservoir, surface sediment. (SP428507)

Fig. 1 Frustule in girdle view.

Fig. 2. Internal valve view.

Fig. 3. Internal detail of valve view showing helictoglossae and rimoportula.

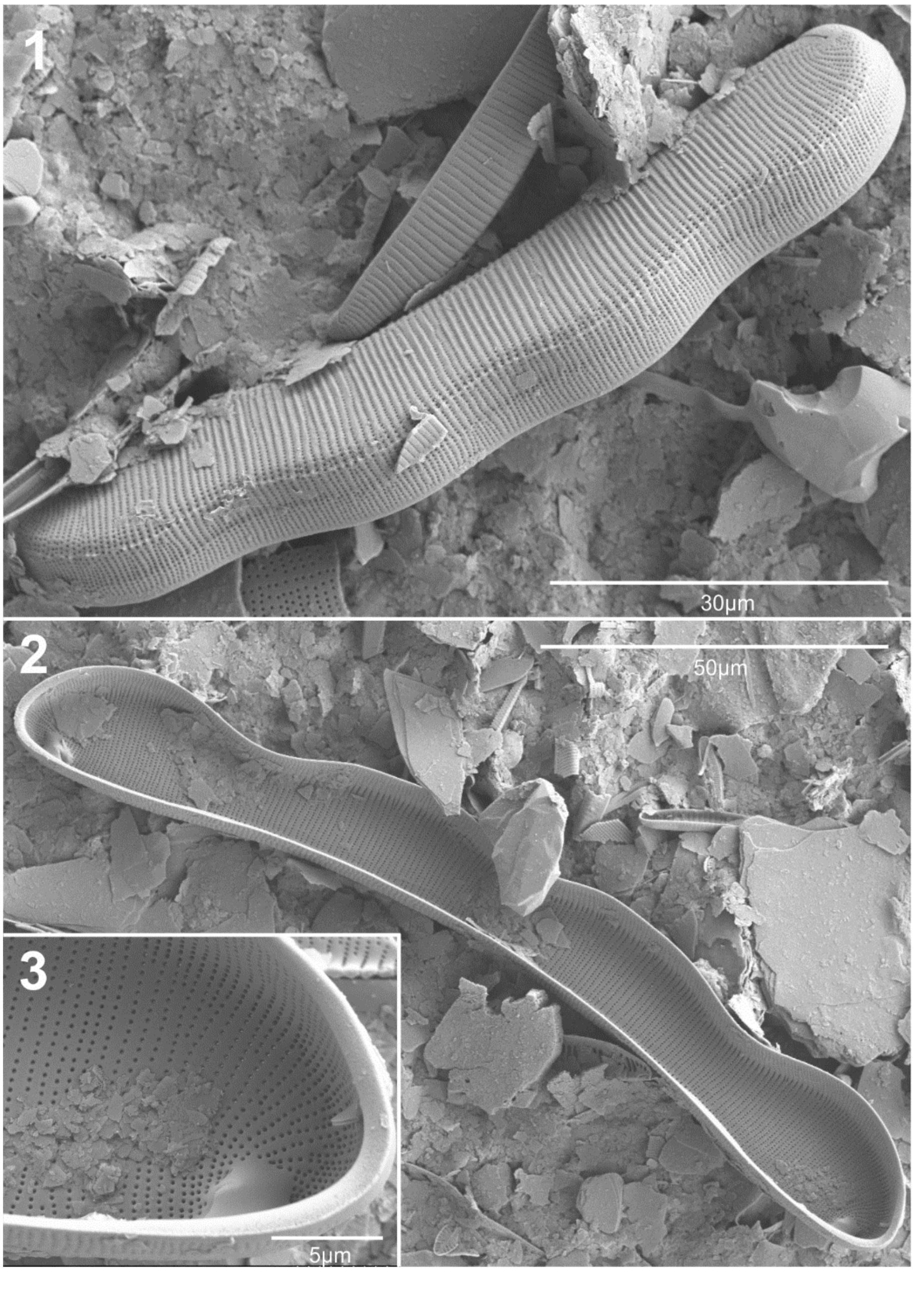

1
30µm
2
50µm
3
5µm

Plate 85

Scale Bar = 10 µm

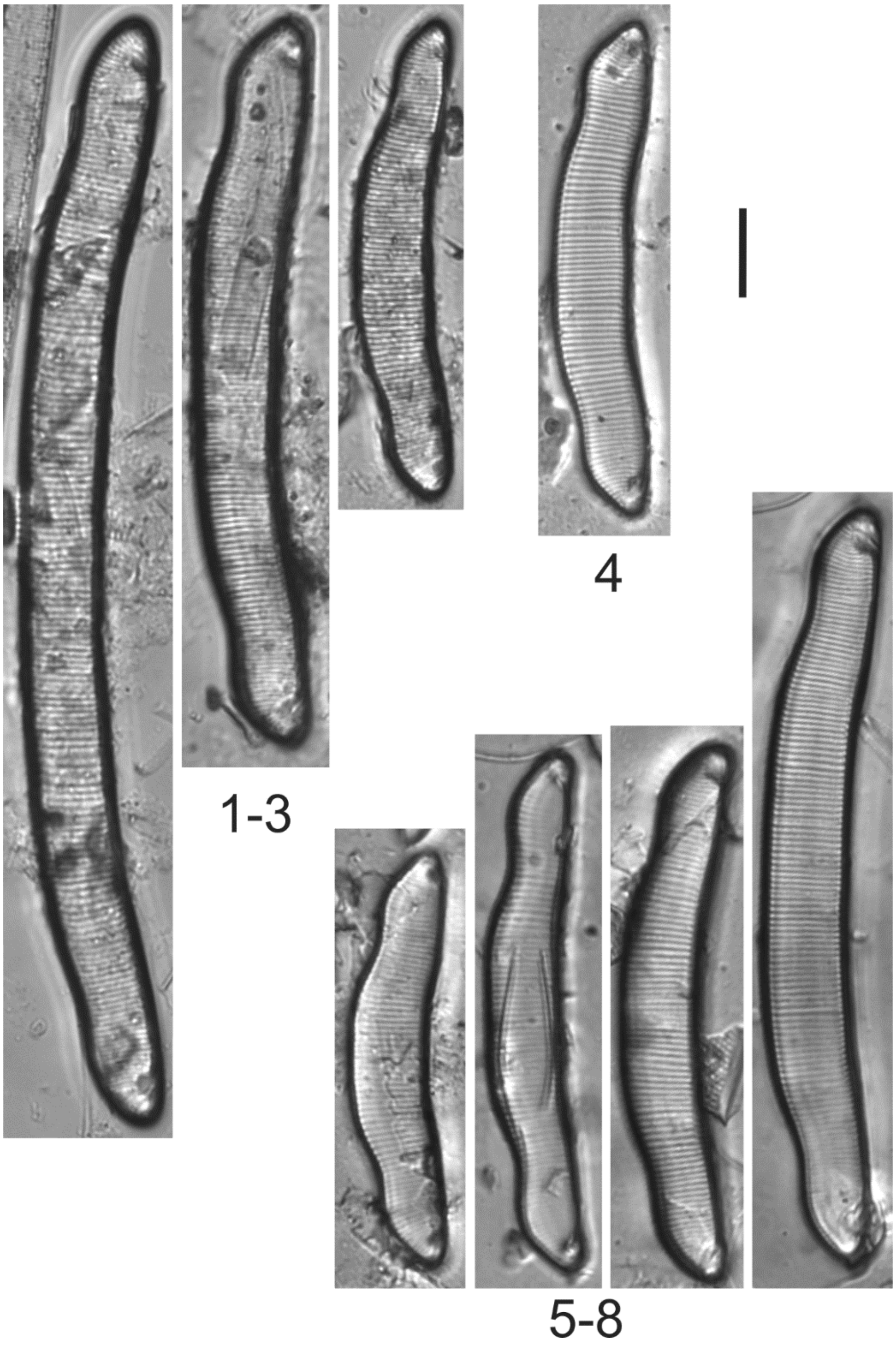
Figs 1-8. *Eunotia pseudoindica* Frenguelli

Figs 1-3. Pedro Beicht reservoir, surface sediment. (SP427580)

Fig. 4. Guarapiranga reservoir, surface sediment. (SP428508)

Figs 5-8. Pedro Beicht reservoir, phytoplankton. (SP427595)

Figs 1-8. Morphometry: Apical axis 46.9-124.7 µm; Transapical axis 8.3-9.8 µm; Striae 13-17 in 10 µm.



1-3
4
5-8

Plate 86

Scale Bar = 10 µm: Figs 1-2

Figs 1-2. ***Eunotia pseudoindica*** Frenguelli

Figs 1-2. Pedro Beicht reservoir, surface sediment. (SP427580)

Fig. 1. Internal valve view.

Fig. 2. Internal detail of valve view showing helictoglossae and rimoportula.

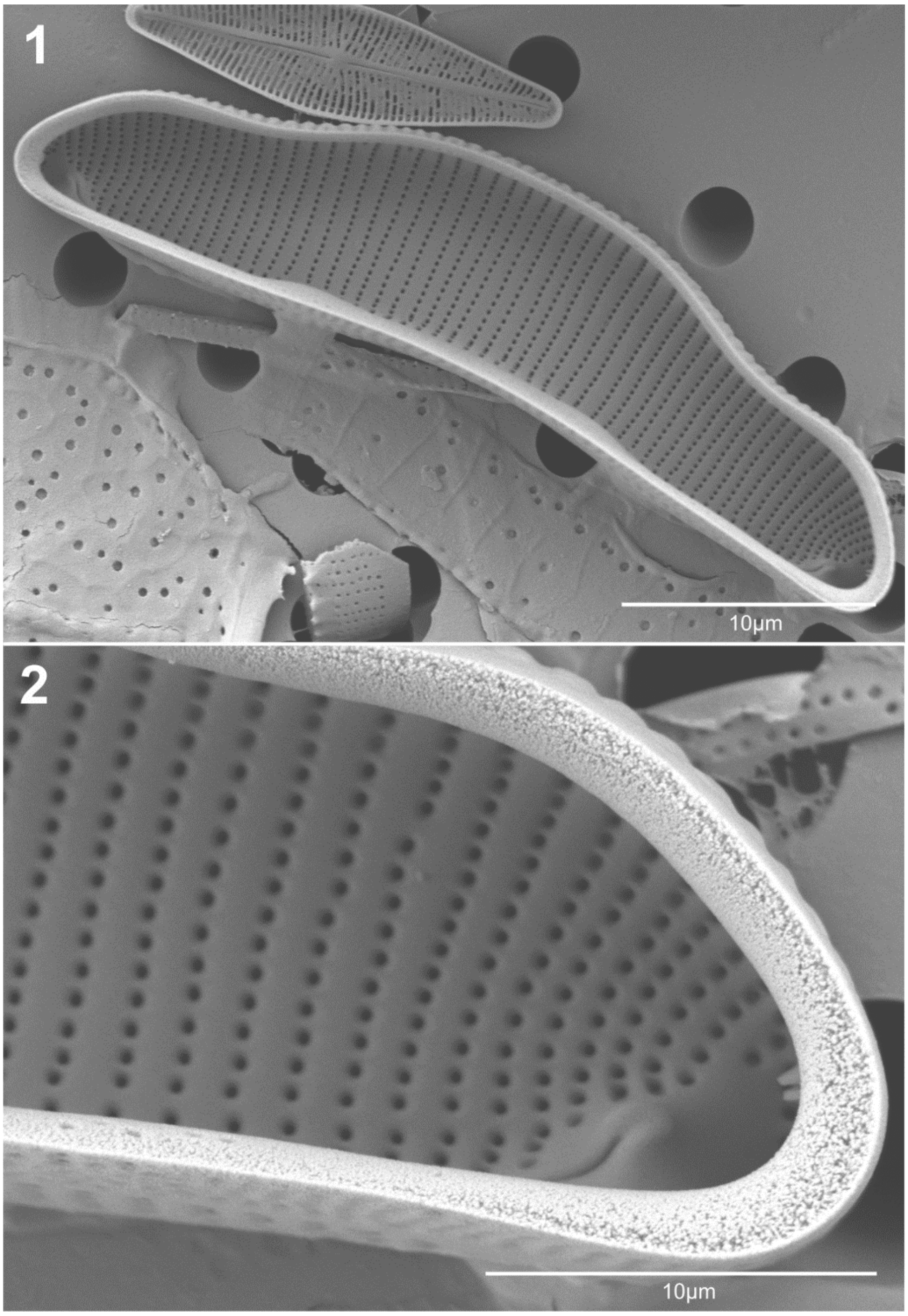

1
10µm
2
10µm

Plate 87

Scale Bar = 10 µm

Figs 1-9. *Eunotia xystriformis* Manguin

Figs 1-7. Taiaçupeba reservoir, periphyton. (SP427987)

Figs 8-9. Pedro Beicht reservoir, surface sediment. (SP427581)

Figs 1-9. Morphometry: Apical axis 51.9-88.7 µm; Transapical axis 7.6-11.3 µm; Striae 13-17 in 10 µm.

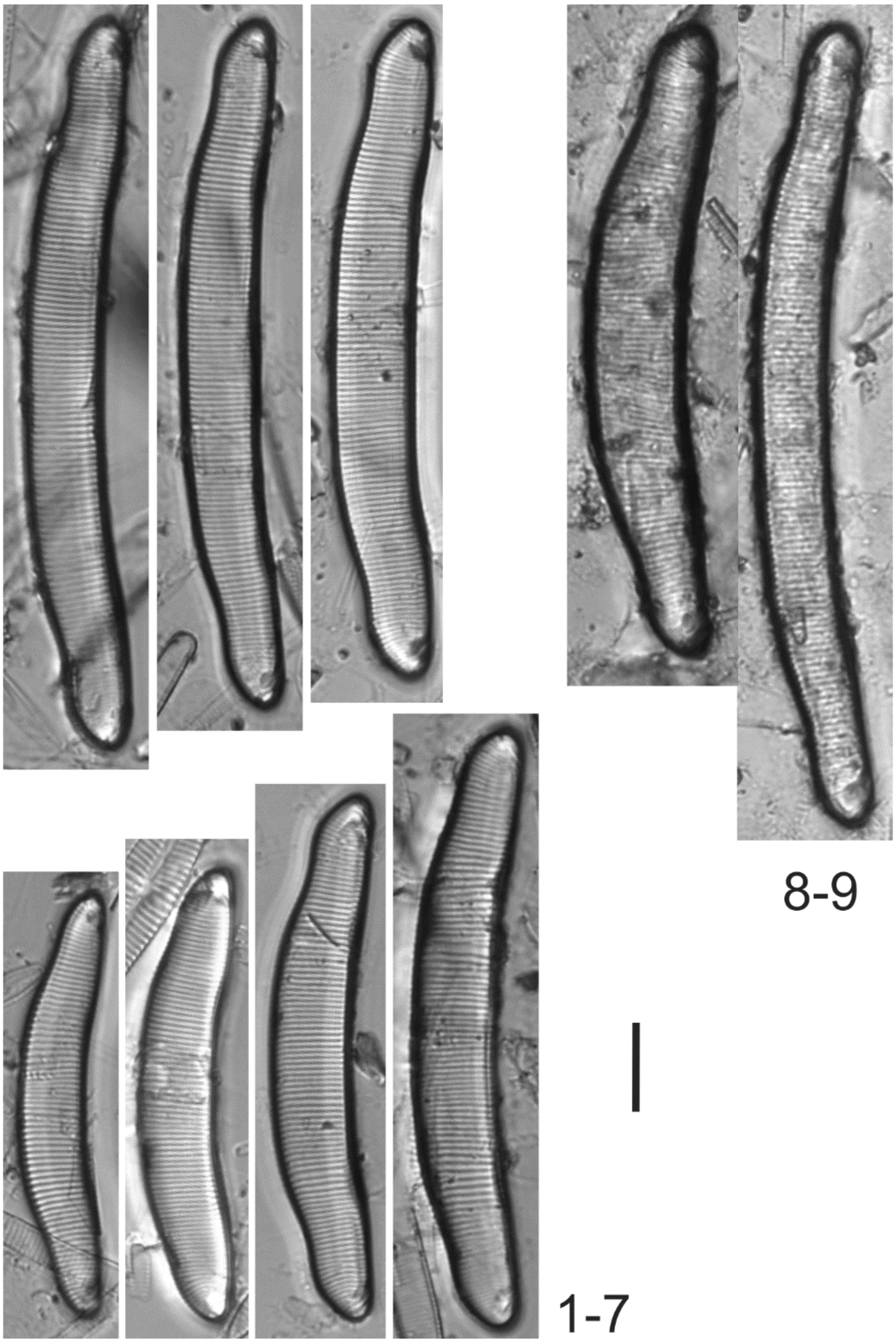

8-9
1-7

Plate 88

Scale Bar = 30 µm: Fig. 1; **5 µm**: Fig. 2

Figs 1-2. ***Eunotia xystriformis*** Manguin

Figs 1-2. Taiaçupeba reservoir, periphyton. (SP427987)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe and spine.

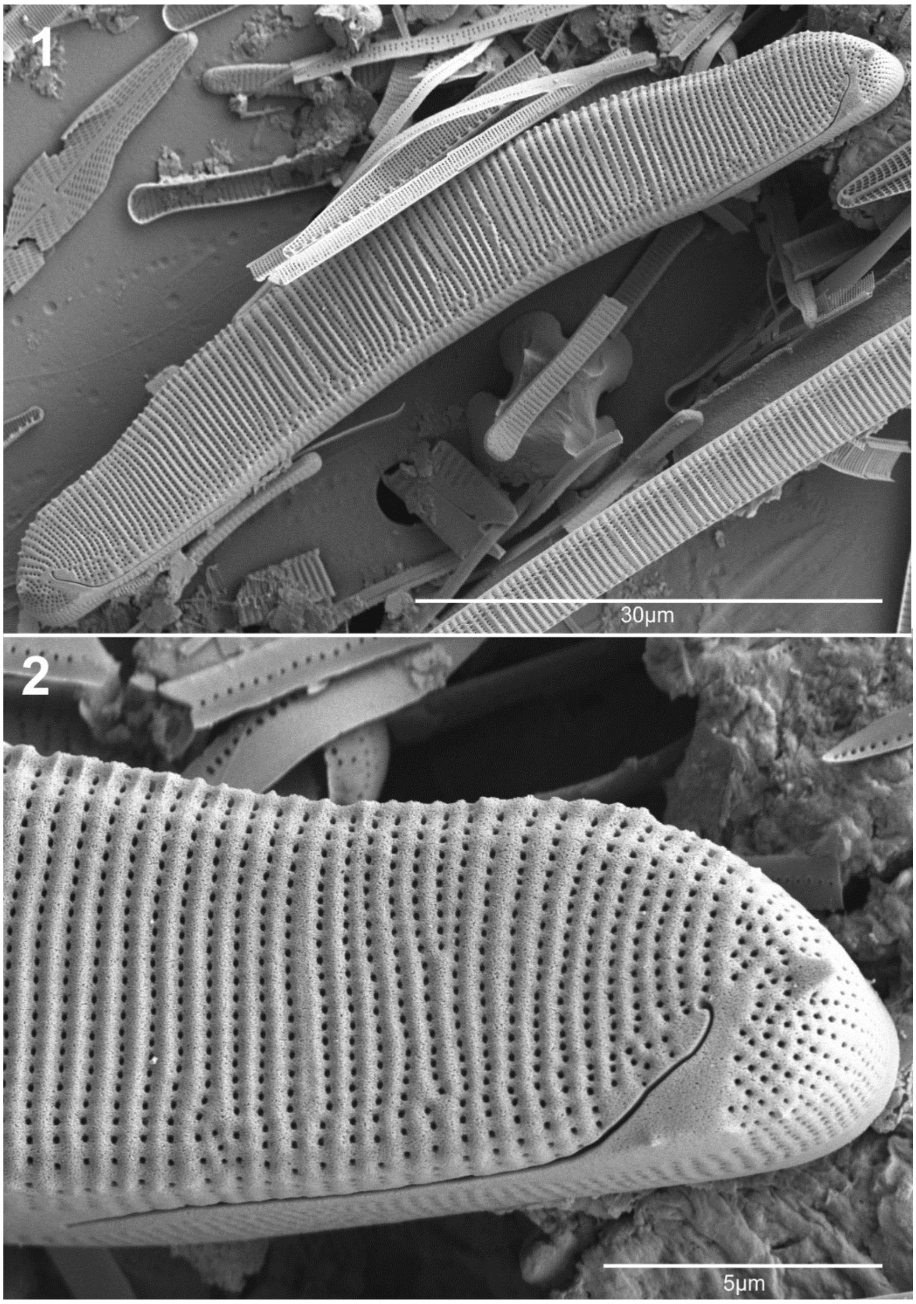

1
30µm
2
5µm

Plate 89

Scale Bar = 40 µm: Figs 1-2; **10 µm**: Fig. 3; **5 µm**: Fig. 4

Figs 1-4. *Eunotia xystriformis* Manguin

Figs 1-4. Pedro Beicht reservoir, surface sediment. (SP427581)

Fig. 1. Internal valve view.

Fig. 2. External valve view.

Fig. 3 Frustule in girdle view.

Fig. 4. External detail of valve view showing raphe and spine.

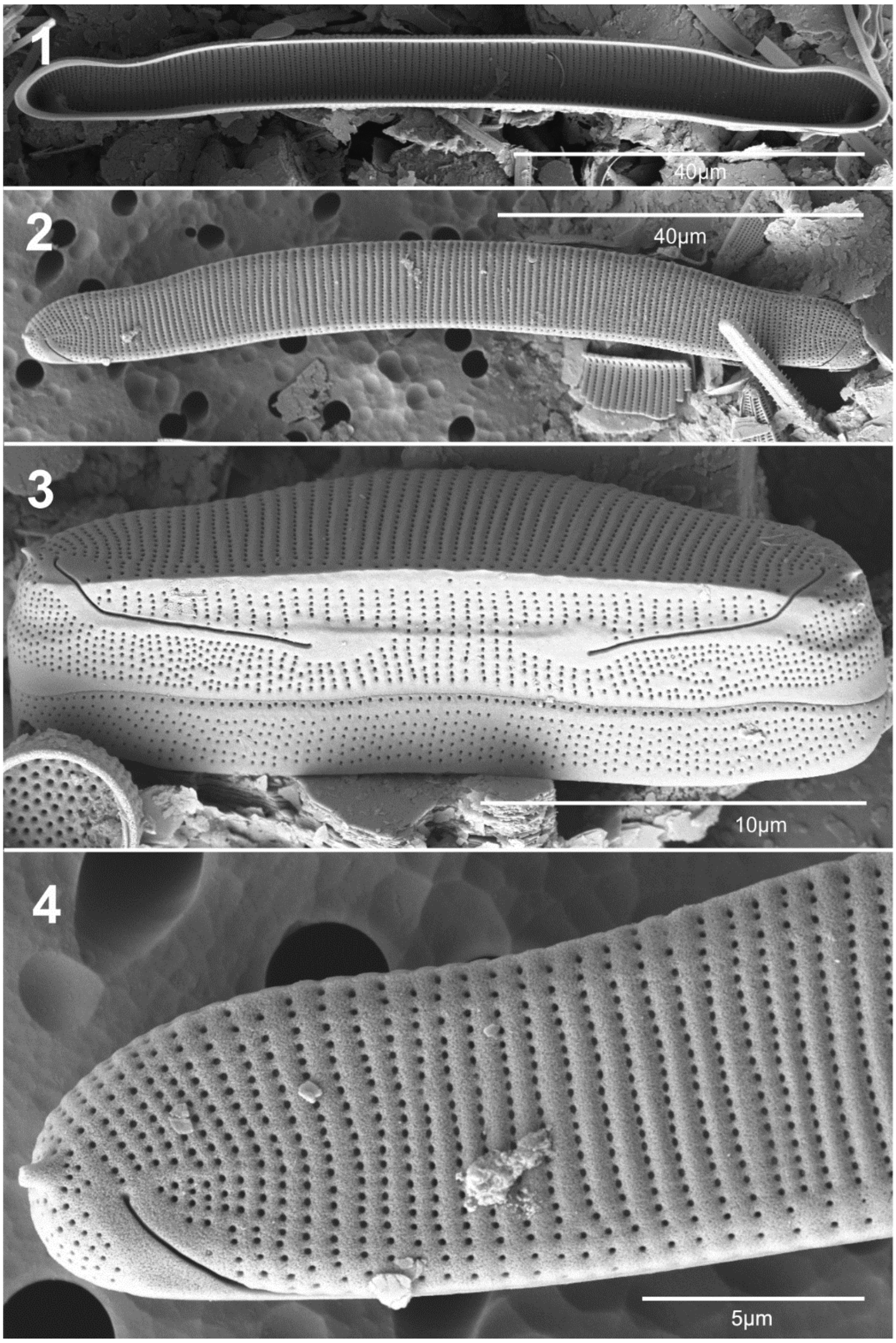

1
40µm
2
40µm
3
10µm
4
5µm

Plate 90

Scale Bar = 10 µm

Figs 1-10. *Eunotia yberai* Frenguelli

Figs 1-5. Hedberg reservoir, periphyton. (SP469534)

Figs 6-10. Salto Grande reservoir, periphyton. (SP469375)

Figs 1-10. Morphometry: Apical axis 24.4-73.4 µm; Transapical axis 7.8-11.7 µm; Striae 9-14 in 10 µm.

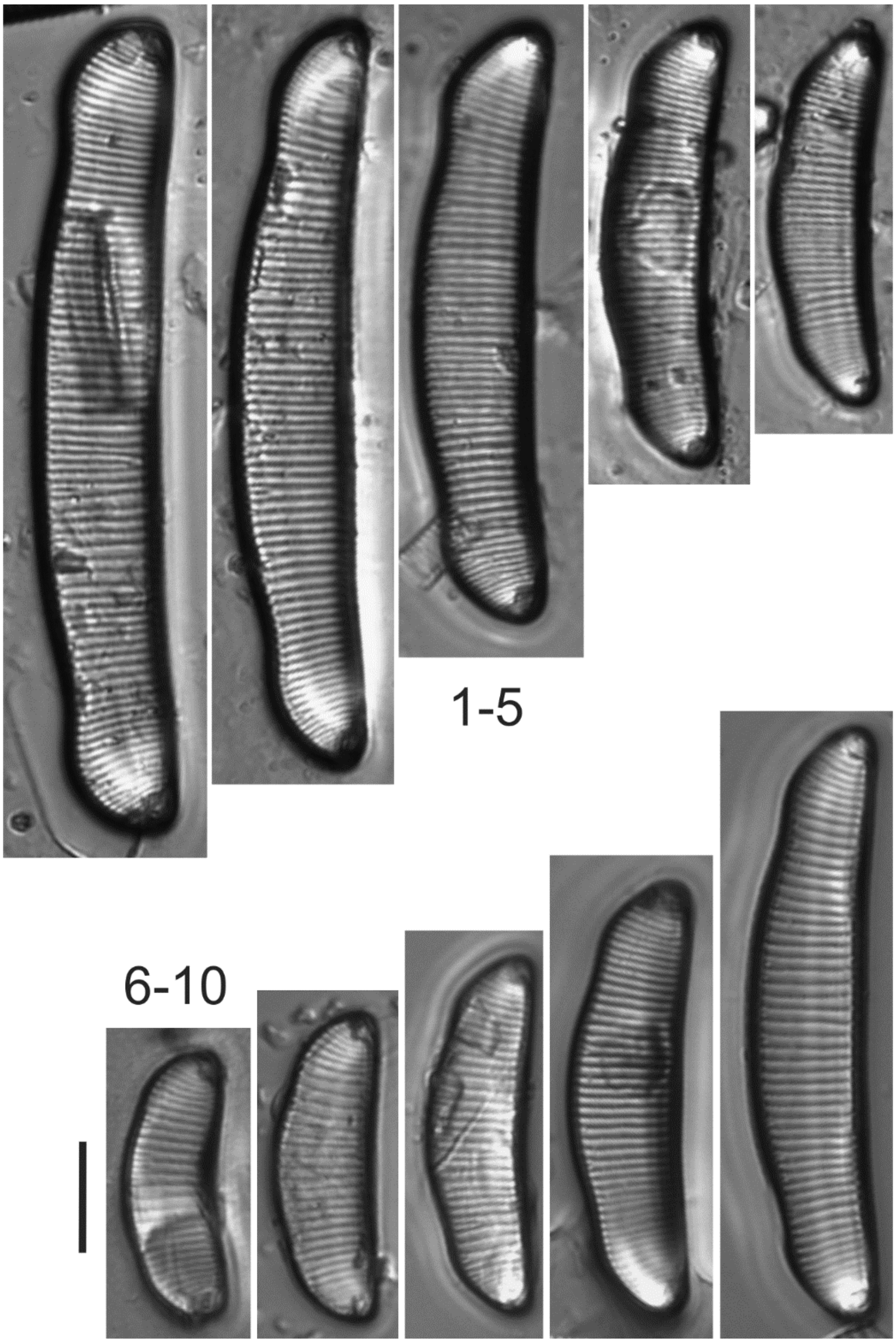

1-5
6-10

Plate 91

Scale Bar = 10 μm: Figs 1-3

Figs 1-3. *Eunotia yberai* Frenguelli

Figs 1-3. Hedberg reservoir, periphyton. (SP469534)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. Frustule in girdle view.

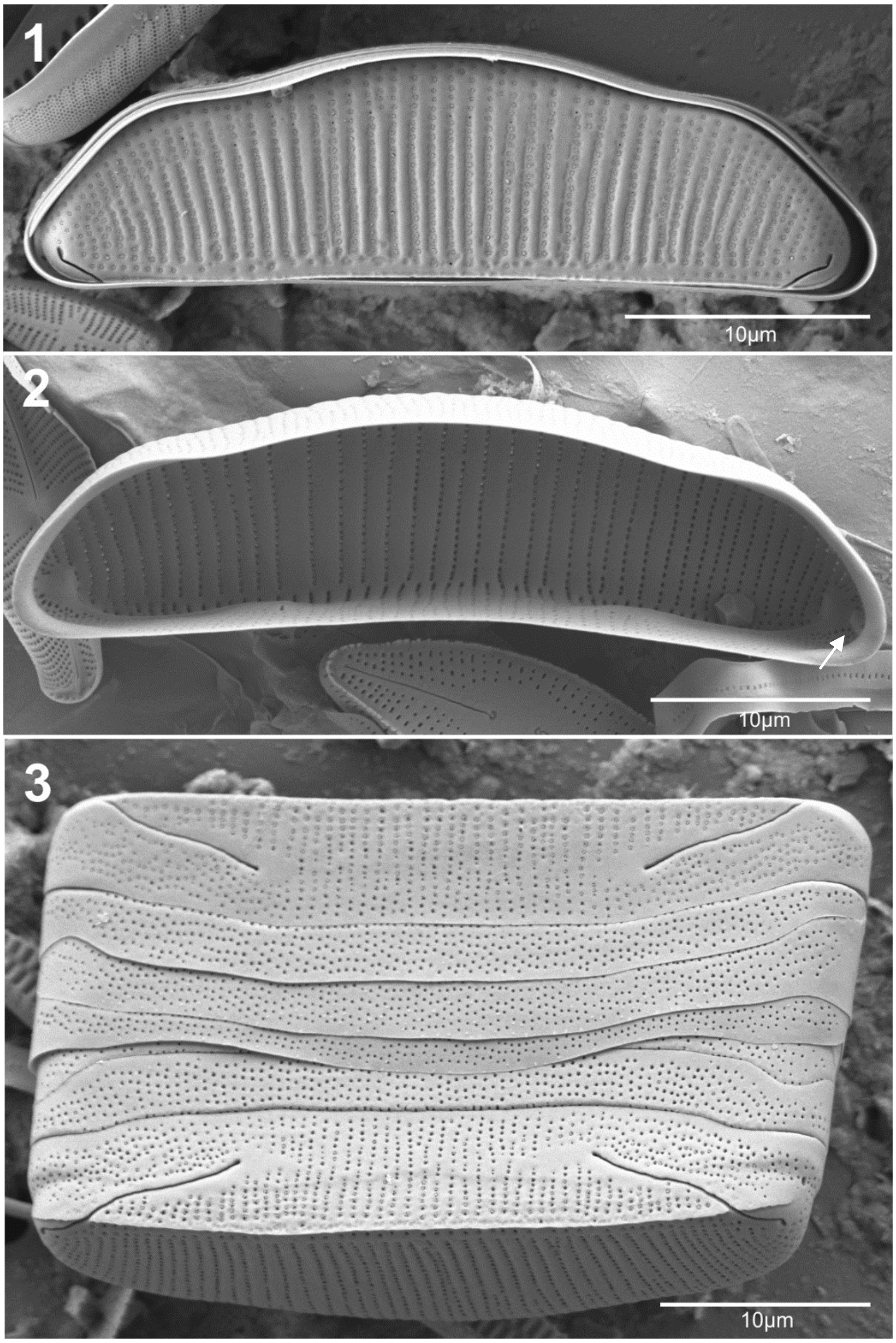

1
10µm
2
10µm
3
10µm

Plate 92

Scale Bar = 10 µm

Figs 1-8. *Eunotia deficiens* Metzeltin, Lange-Bertalot & García-Rodríguez

Figs 1-5. Paraitinga reservoir, periphyton. (SP427984)

Figs 6-8. Salto Grande reservoir, periphyton. (SP469372)

Figs 1-8. Morphometry: Apical axis 26.5-85.2 µm; Transapical axis 6.1-10.8 µm; Striae 9-11 in 10 µm.

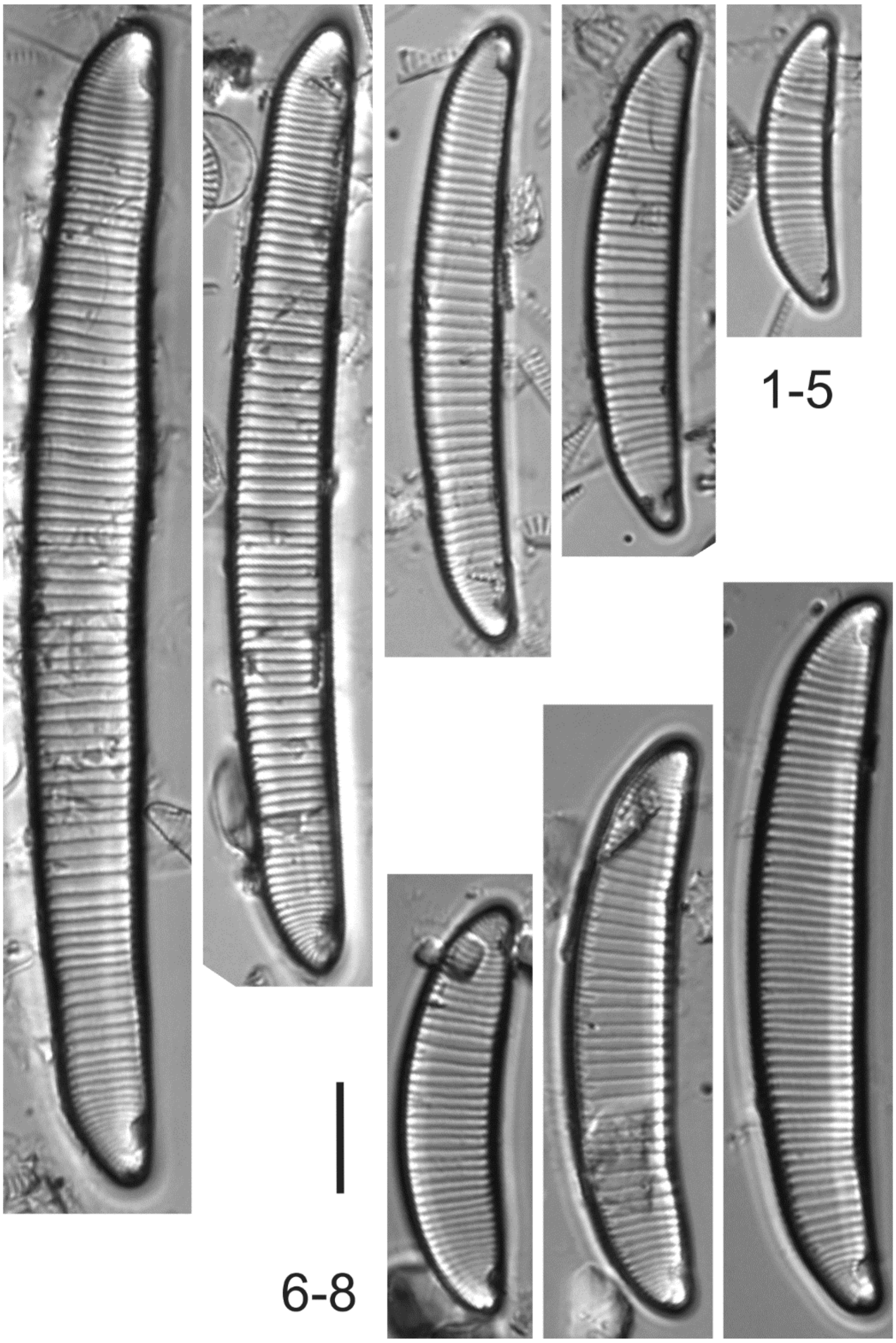

1-5
6-8

Plate 93

Scale Bar = 20 µm: Figs 1-2; **5 µm**: Figs 3-4

Figs 1-4. *Eunotia deficiens* Metzeltin, Lange-Bertalot & García-Rodríguez

Figs 1-4. Paraitinga reservoir, periphyton. (SP427984)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

Fig. 3. External detail of valve view showing raphe and rimoportula.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

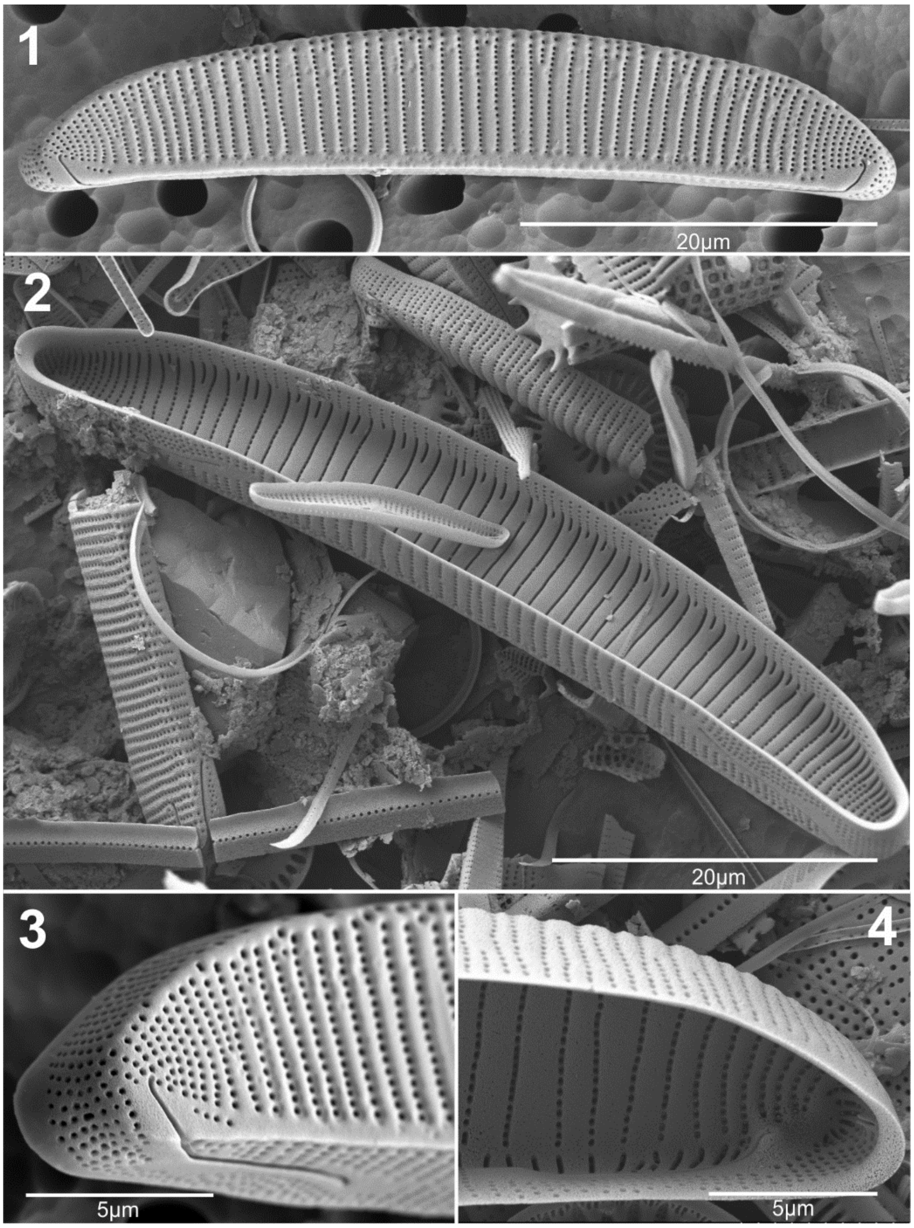

1
20µm
2
20µm
3
5µm
4
5µm

Plate 94

Scale Bar = 10 µm

Figs 1-8. ***Eunotia didyma*** Hustedt ex Zimmermann

Figs 1-8. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-8. Morphometry: Apical axis 28.6-99.8 µm; Transapical axis 12.9-18.9 µm; Striae 7-10 in 10 µm.

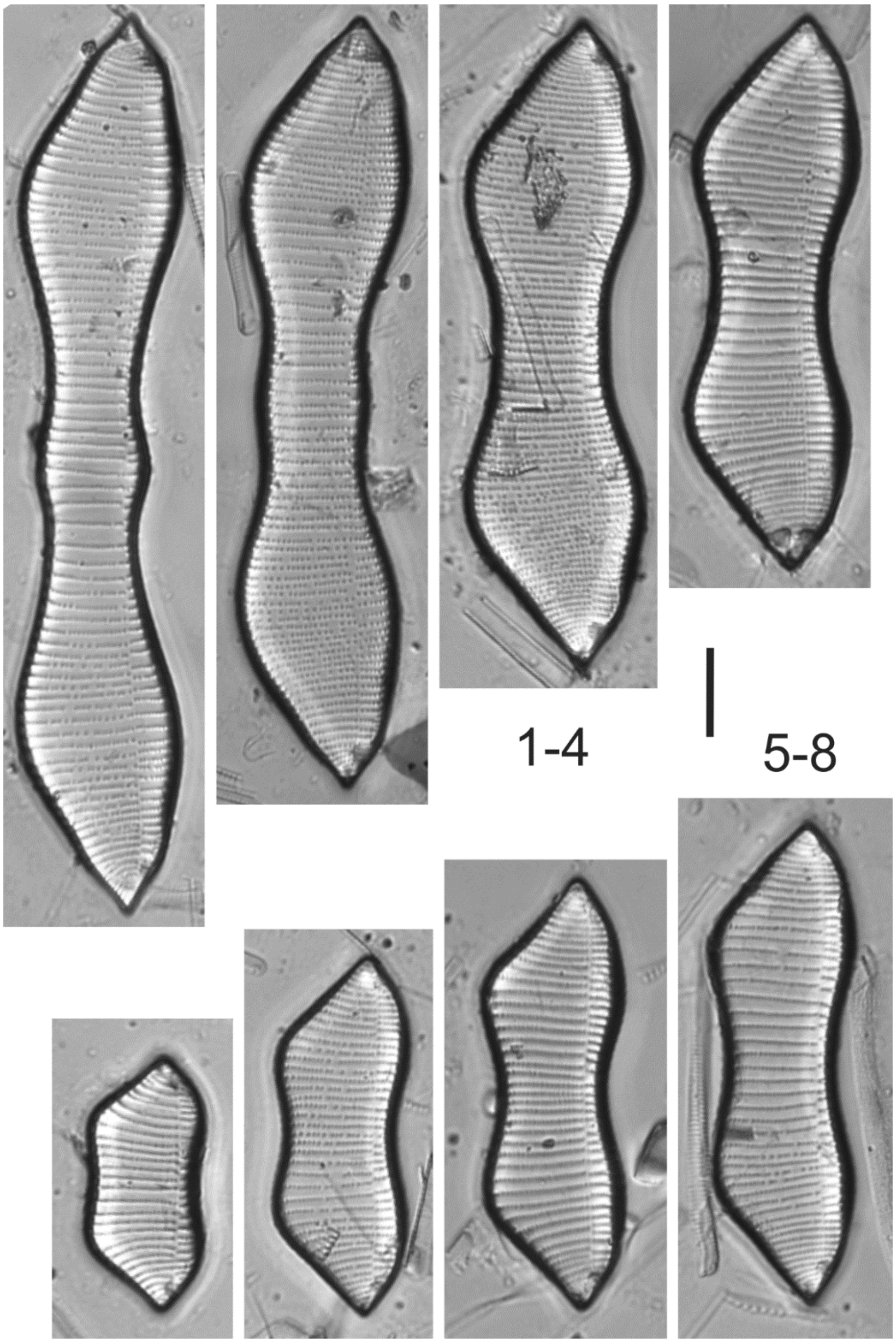

1-4
5-8

Plate 95

Scale Bar = 30 µm: Fig. 3; **20 µm**: Fig. 1; **5 µm**: Figs 2, 4

Figs 1-4. *Eunotia didyma* Hustedt ex Zimmermann

Figs 1-4. Ponte Nova reservoir, periphyton. (SP427983)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe.

Fig. 3. Internal valve view.

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

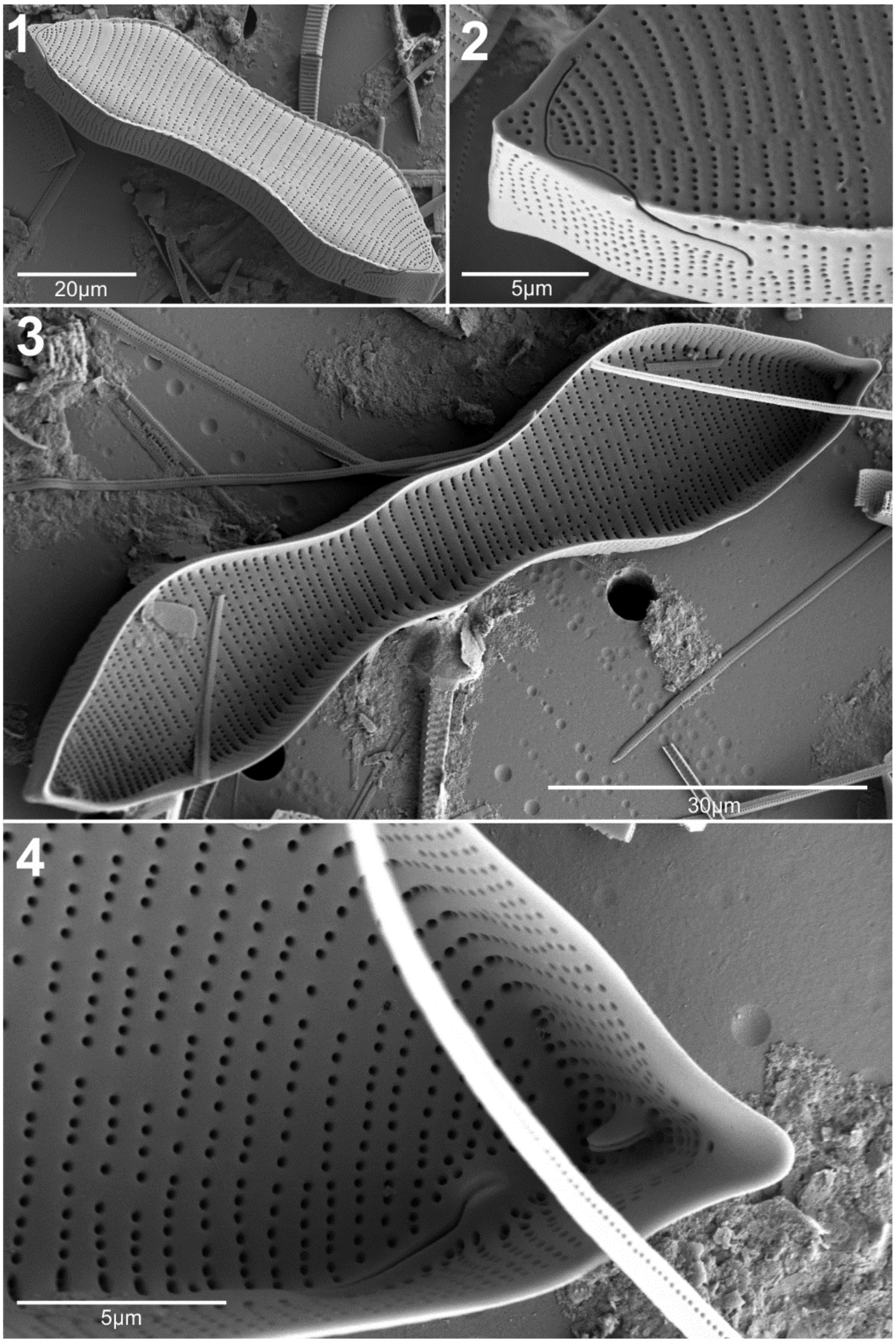

1
20µm
2
5µm
3
30µm
4
5µm

Plate 96

Scale Bar = 10 µm

Figs 1-4. *Eunotia neomundana* Metzeltin & Lange-Bertalot

Figs 1-4. Tatu reservoir, periphyton. (SP469385)

Figs 1-4. Morphometry: Apical axis 57.9-95.3 µm; Transapical axis 12-14.5 µm; Striae 9-10 in 10 µm.

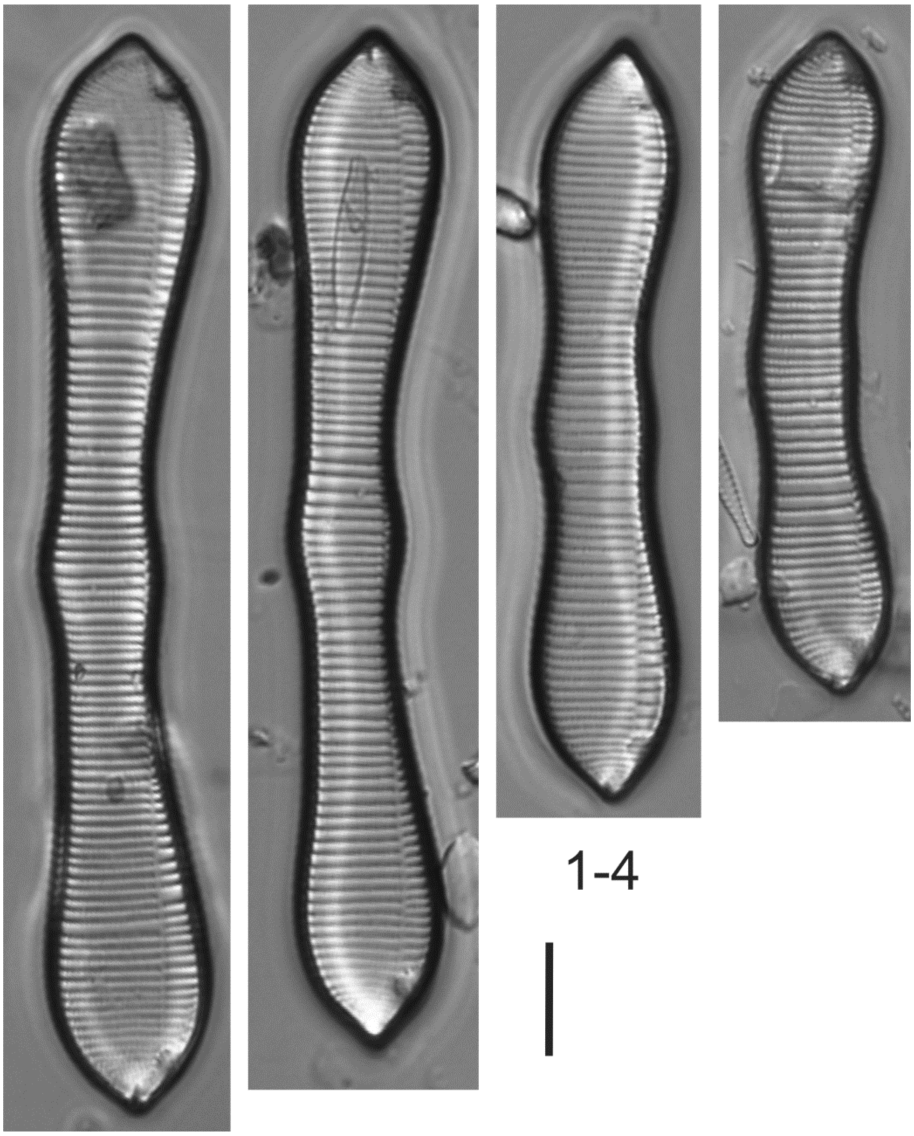

1-4

Plate 97

Scale Bar = 10 µm

Figs 1-11. *Eunotia formica* Ehrenberg

Figs 1-11. Paiva Castro reservoir, periphyton. (SP469379)

Figs 1-11. Morphometry: Apical axis 31.1-124.9 µm; Transapical axis 7.7-10.6 µm; Striae 7-12 in 10 µm.

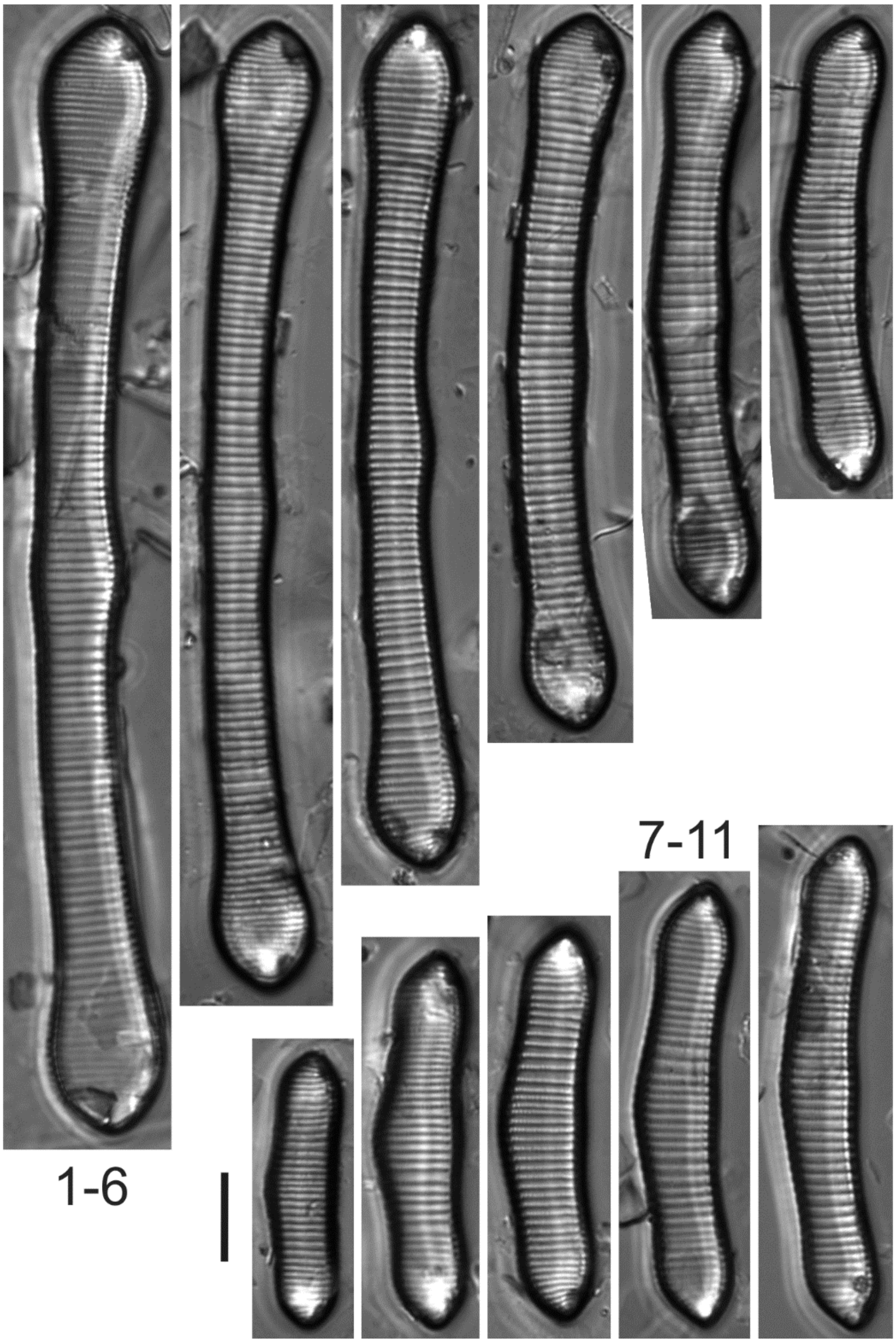

1-6
7-11

Plate 98

Scale Bar = 40 µm: Fig. 1; **20 µm**: Fig. 2

Figs 1-2. ***Eunotia formica*** Ehrenberg

Figs 1-2. Paiva Castro reservoir, periphyton. (SP469379)

Fig. 1. External valve view.

Fig. 2. Internal valve view.

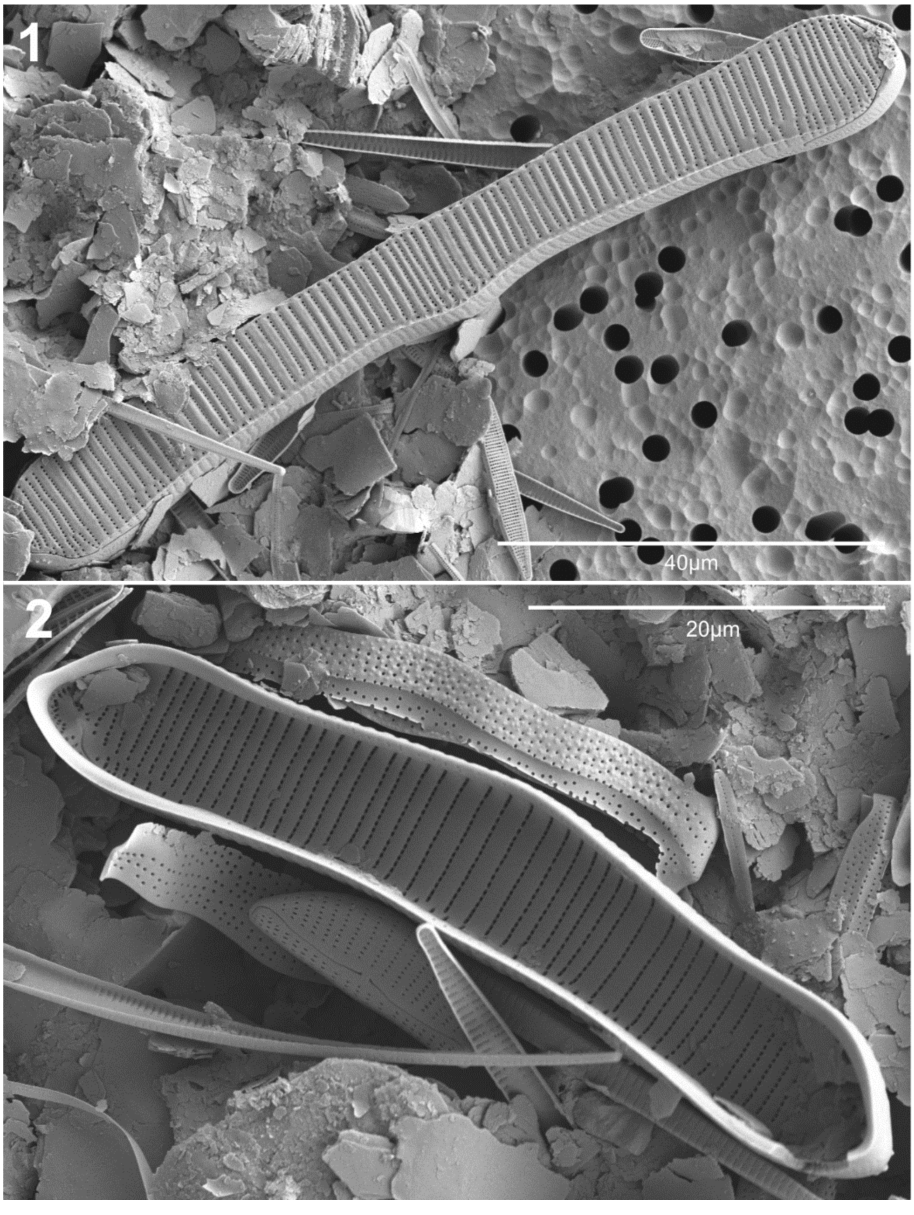

1
40μm
2
20μm

Plate 99

Scale Bar = 40 µm: Fig. 3; **30 µm**: Fig. 1; **20 µm**: Fig. 2; **5 µm**: Fig. 4

Figs 1-4. *Eunotia formica* Ehrenberg

Figs 1-4. Guarapiranga reservoir, surface sediment. (SP428507)

Figs 1-2. External valve view.

Fig. 3. Frustule in girdle view

Fig. 4. Internal detail of valve view showing helictoglossae and rimoportula.

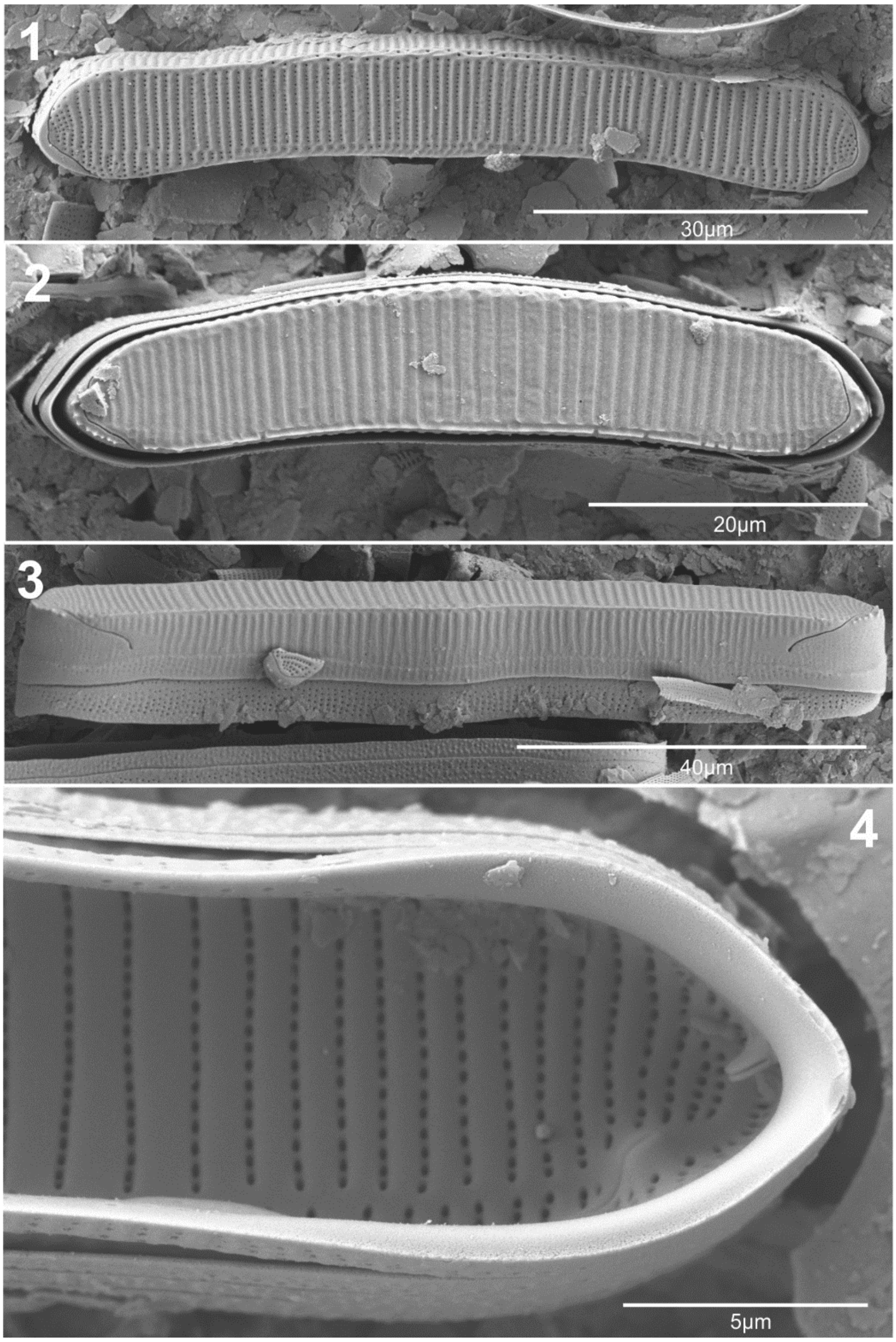

1
30µm
2
20µm
3
40µm
4
5µm

Plate 100

Scale Bar = 10 µm

Figs 1-5. *Eunotia formicina* Lange-Bertalot

Fig. 1. Jundiaí reservoir, surface sediment. (SP468858)

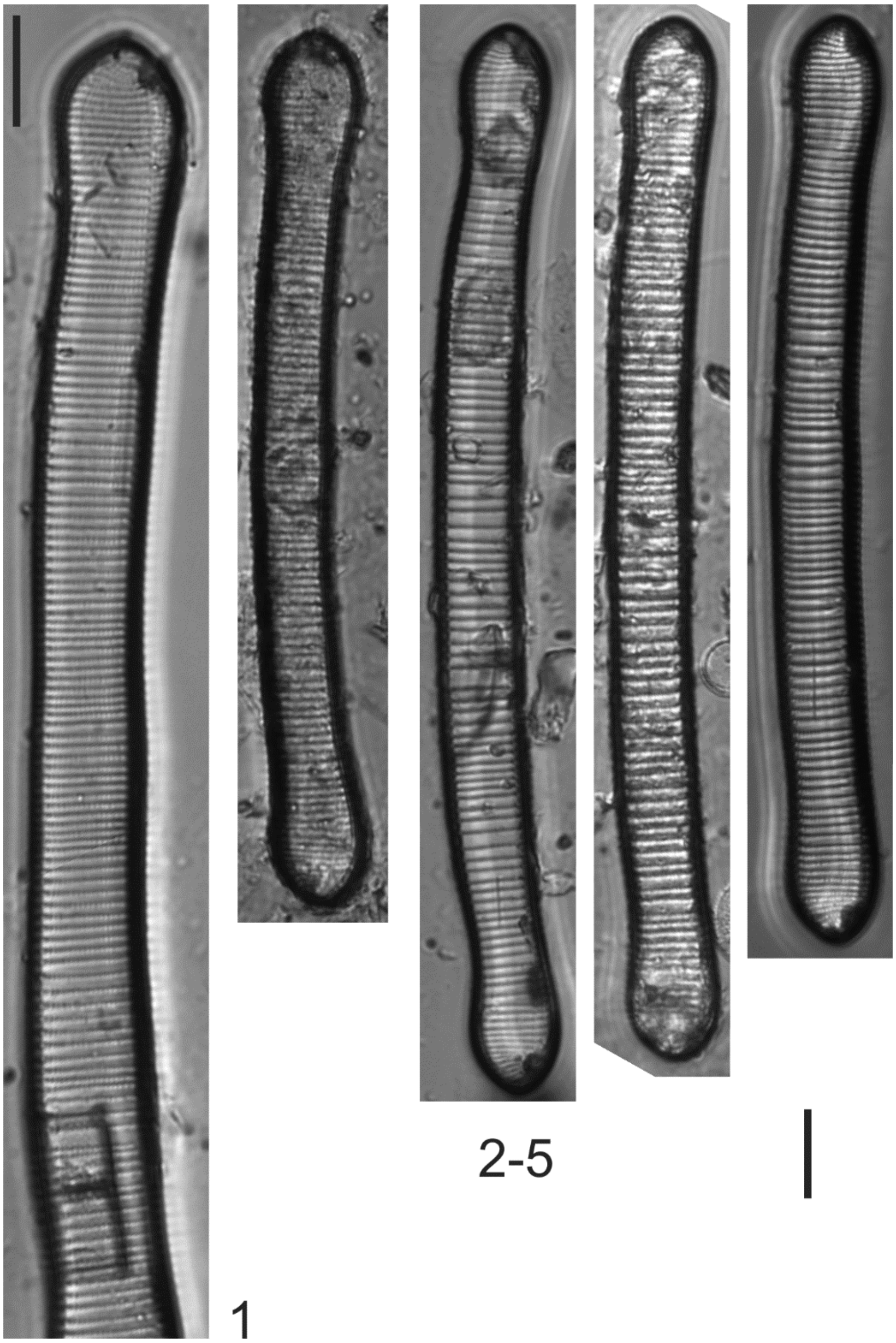
Fig. 2. Cachoeira da Graça reservoir, surface sediment (SP427583)

Fig. 3. Ribeirão do Campo reservoir, surface sediment (SP468843)

Fig. 4. Jurupará reservoir, surface sediment. (SP469211)

Fig. 5. Guarapiranga reservoir, phytoplankton. (SP469470)

Figs 1-5. Morphometry: Apical axis 98.1-163 µm; Transapical axis 8.2-10.1 µm; Striae 8-12 in 10 µm.



1

2-5

Plate 101

Scale Bar = 10 µm

Figs 1-4. *Eunotia* sp. 11

Figs 1-4. Hedberg reservoir, periphyton. (SP469534)

Figs 1-4. Morphometry: Apical axis 100.6-152.4 µm; Transapical axis 9.2-10.3 µm; Striae 10-12 in 10 µm.

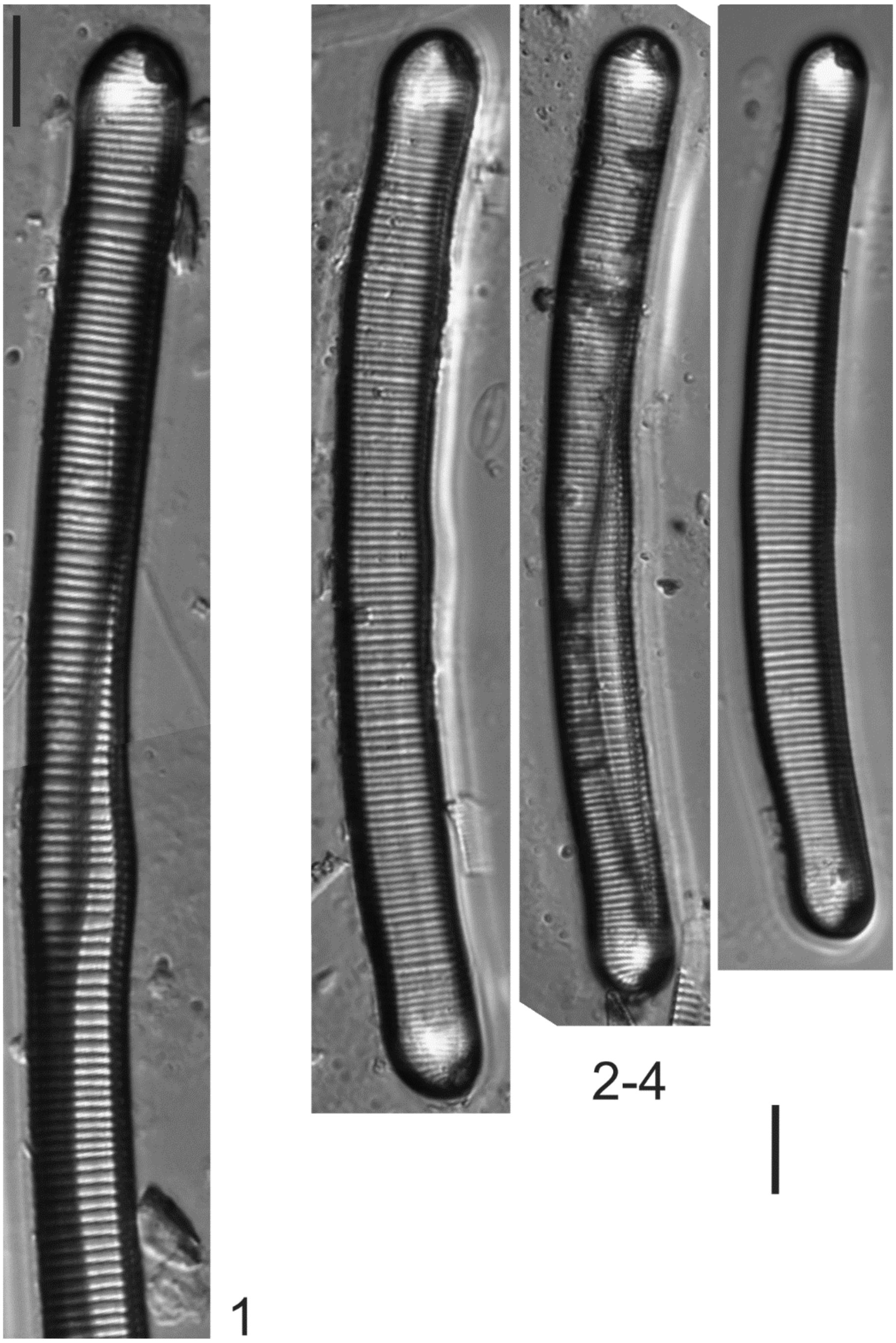

1
2-4

Plate 102

Scale Bar = 50 µm: Fig. 1; **10 µm**: Fig. 2; **5 µm**: Figs 3-4

Figs 1-4. *Eunotia* sp. 11

Figs 1-4. Hedberg reservoir, periphyton. (SP469534)

Fig. 1. External valve view.

Fig. 2. External detail of valve view showing raphe.

Figs 3-4. Internal detail of valve view showing helictoglossae and rimoportula.

Figs 1-4. Morphometry: Apical axis 100.6-152.4 µm; Transapical axis 9.2-10.3 µm; Striae 10-12 in 10 µm.

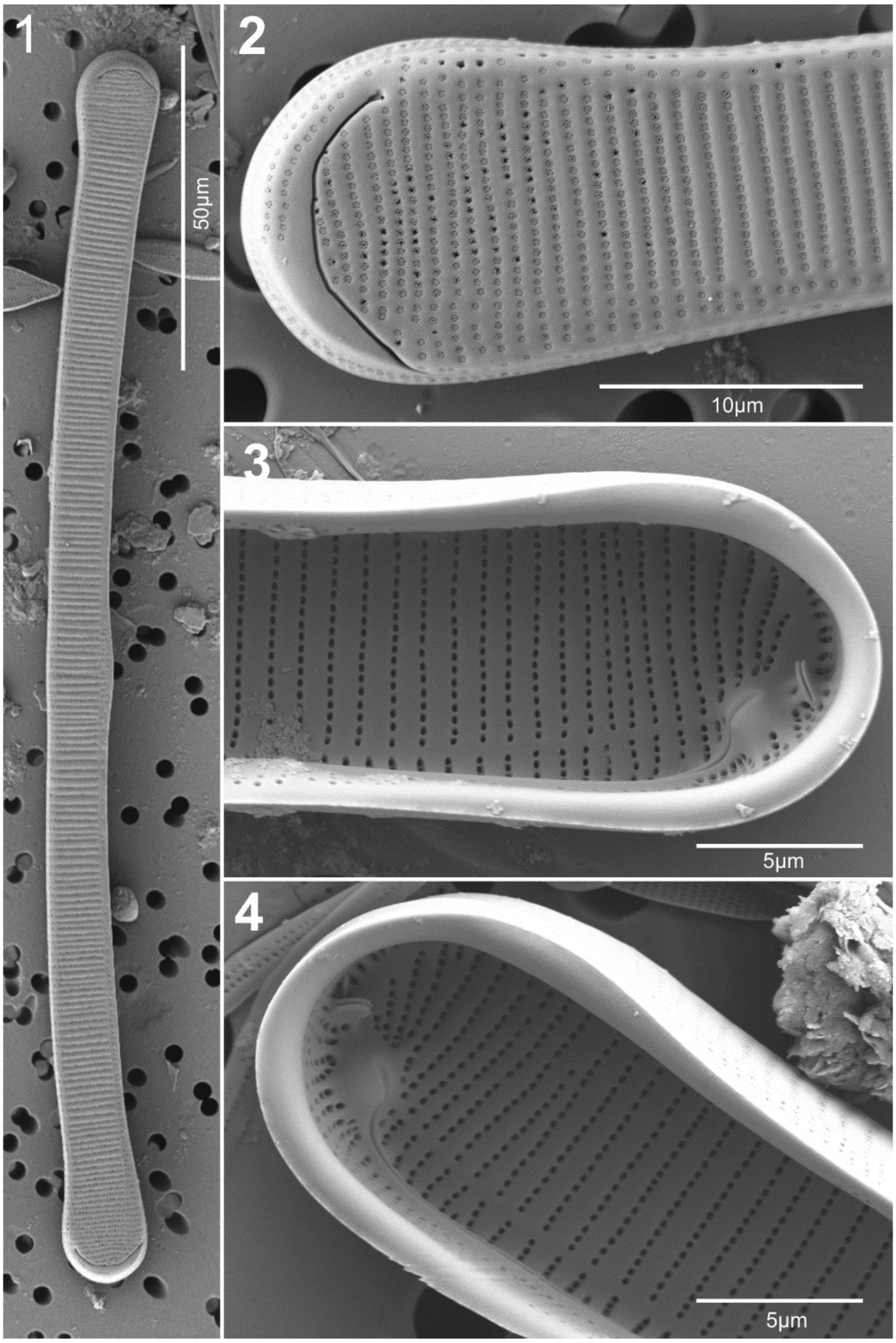

1
50µm
2
10µm
3
5µm
4
5µm

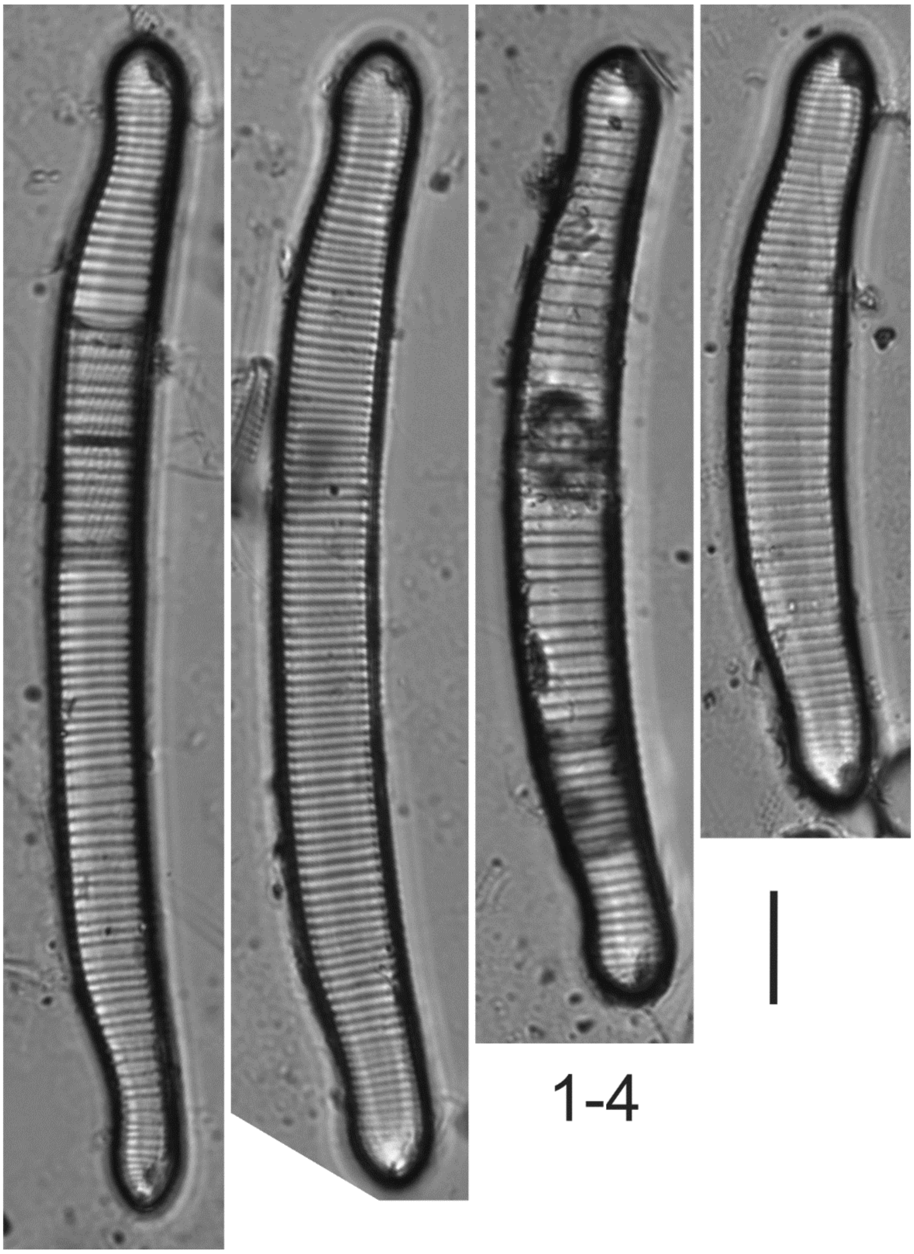
Plate 103

Scale Bar = 10 µm

Figs 1-4. *Eunotia monodon* Ehrenberg

Figs 1-4. Jundiaí reservoir, surface sediment. (SP468850)

Figs 1-4. Morphometry: Apical axis 68.6-103.9 µm; Transapical axis 8.6-9.9 µm; Striae 8-10 in 10 µm.



1-4

Plate 104

Scale Bar = 10 µm

Figs 1-5. *Eunotia karenae* Metzeltin & Lange-Bertalot

Figs 1-3. Cabuçu reservoir, surface sediment. (SP428983)

Figs 4-5. Ponte Nova reservoir, periphyton. (SP427983)

Figs 1-5. Morphometry: Apical axis 101.3-148.7 µm; Transapical axis 6.3-7.9 µm; Striae 10-13 in 10 µm.

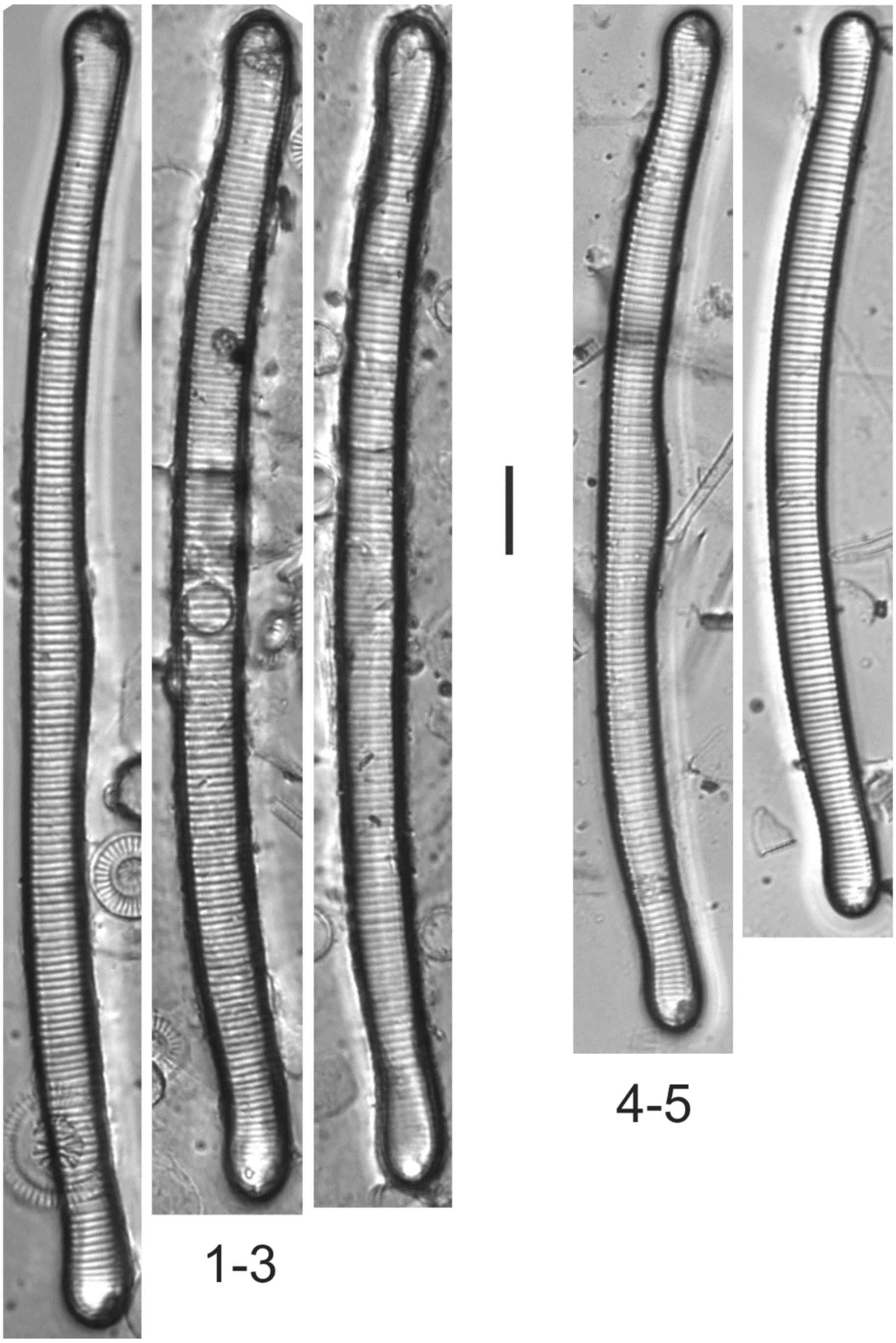

1-3
4-5

Plate 105

Scale Bar = 50 µm: Fig. 1; **5 µm**: Figs 2-3

Figs 1-3. *Eunotia karenae* Metzeltin & Lange-Bertalot

Figs 1-3. Ponte Nova reservoir, periphyton. (SP427983)

Fig. 1. External valve view.

Figs 2-3. External detail of valve view showing raphe.

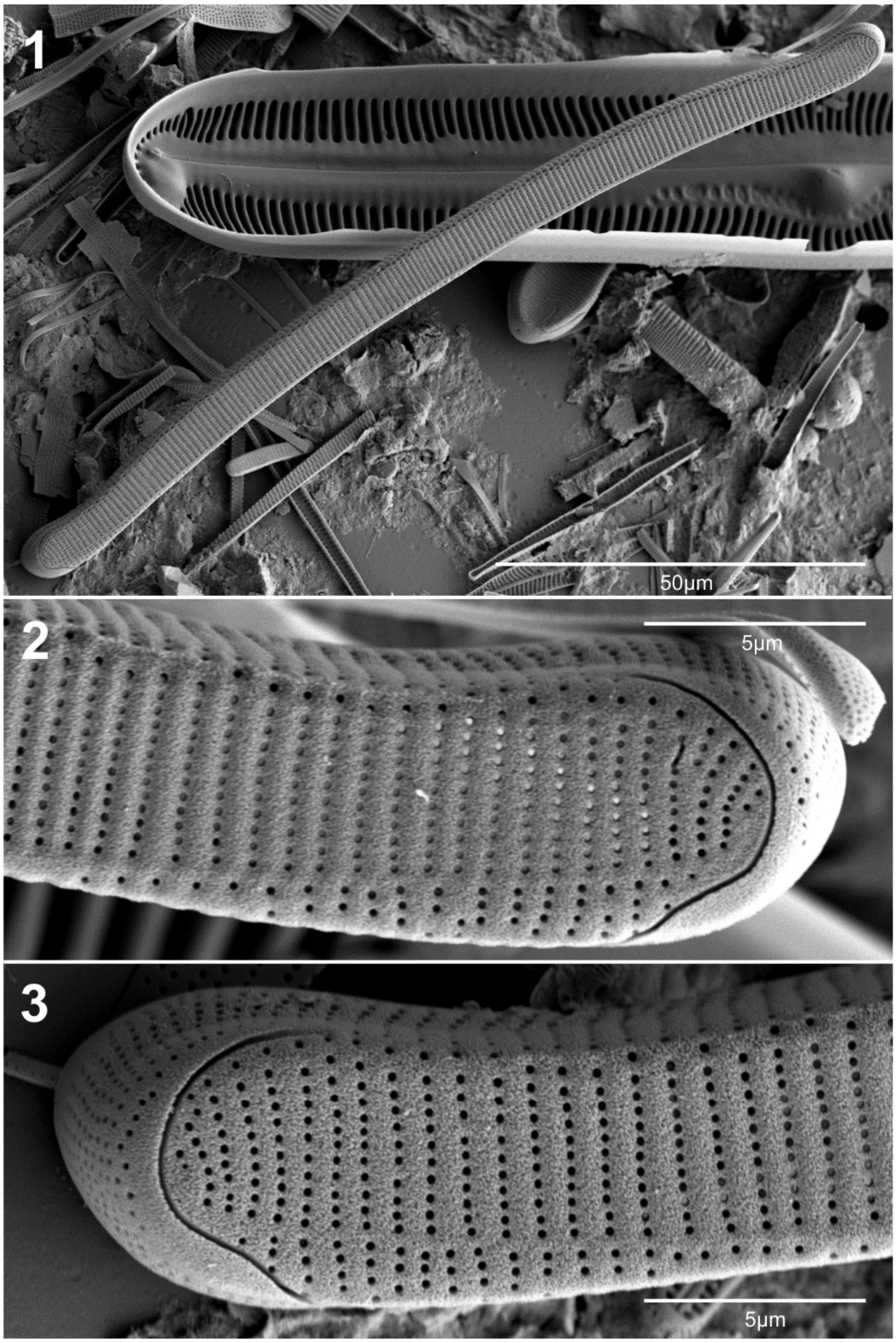

1
50µm
2
5µm
3
5µm

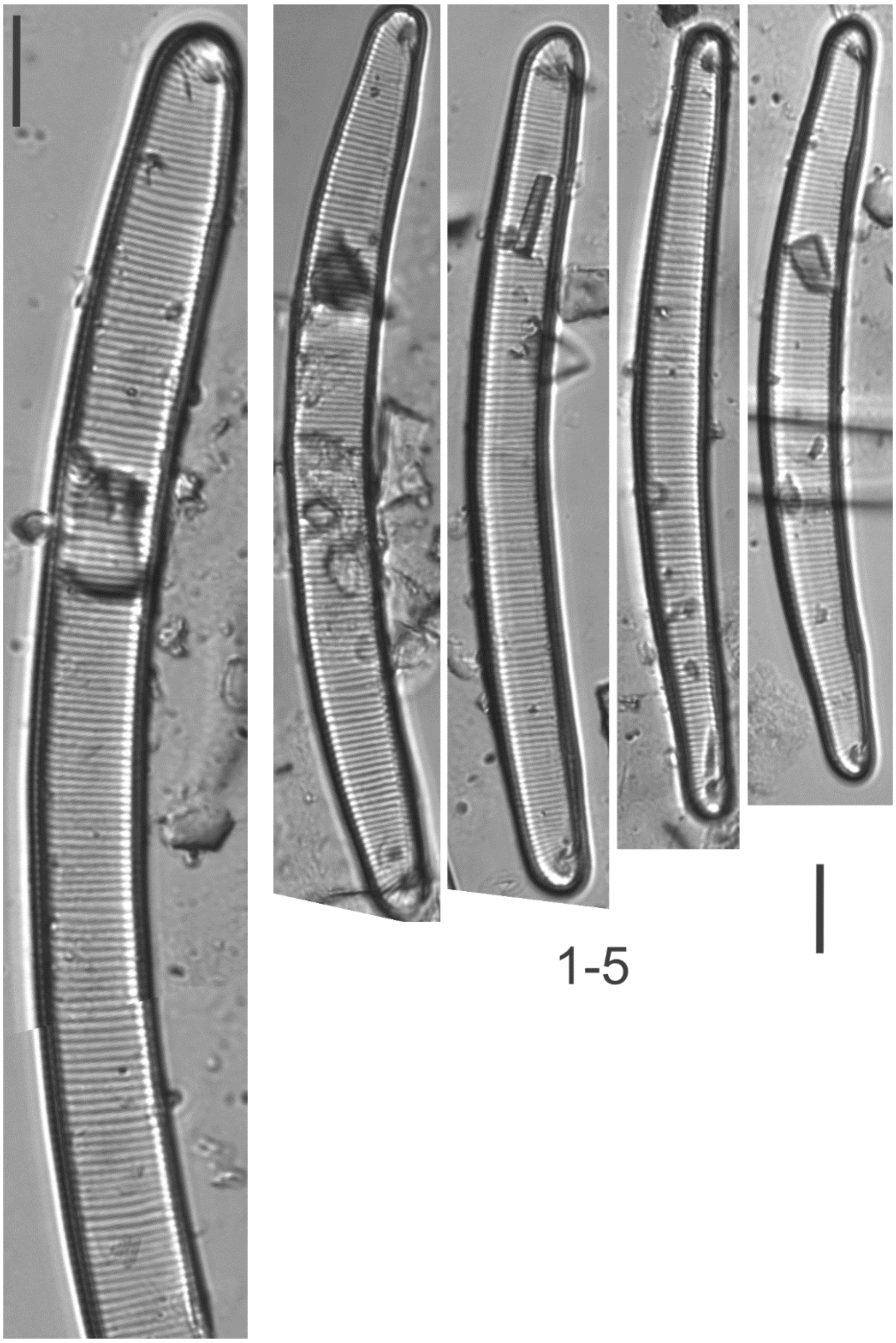
Plate 106

Scale Bar = 10 µm

Figs 1-5. *Eunotia* sp. nov. 12

Figs 1-5. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 1-5. Morphometry: Apical axis 86.9-133.7 µm; Transapical axis 7.9-9.9 µm; Striae 12-16 in 10 µm.



1-5

Plate 107

Scale Bar = 10 µm

Figs 1-3. *Eunotia* sp. 12

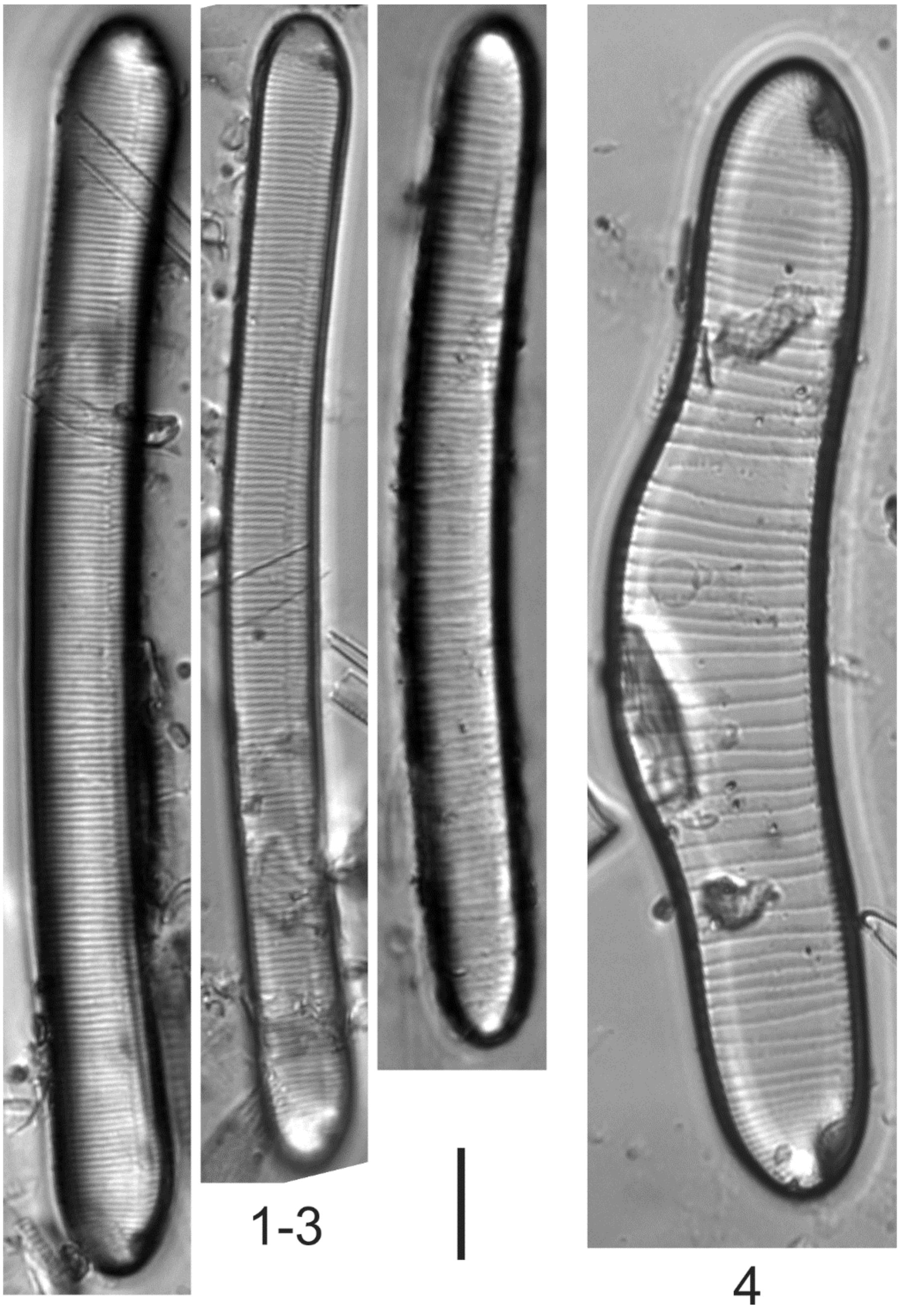
Fig. 4. *Eunotia fuhrmannii* Metzeltin & Tremarin

Figs 1-3. Guarapiranga reservoir, surface sediment. (SP428507)

Fig. 4. Ribeirão do Campo reservoir, surface sediment. (SP468843)

Figs 1-3. Morphometry: Apical axis 103.7-112.9 µm; Transapical axis 7.6-9.3 µm; Striae 12-17 in 10 µm.

Fig. 4. Morphometry: Apical axis 102.2 µm; Transapical axis 19.3 µm; Striae 8 in 10 µm.


1-3
4

8. CONSIDERAÇÕES FINAIS

- ✓ O gênero *Eunotia* foi bastante rico taxonomicamente na área de estudo e representado por 85 táxons. Dentre estes, 58 identificados em nível específico, cinco em nível infraespecífico, 11 foram considerados novas espécies e 12 foram identificados em nível genérico.
- ✓ Treze táxons específicos e um infraespecífico foram reportados pioneiramente para o Brasil, quais sejam: *Desmogonium ossiculum*, *Eunotia bicornigera*, *E. desmogonioides*, *E. fallacoides*, *E. formicina*, *E. incisatula*, *E. juettnerae*, *E. karenae*, *E. kruegeri*, *E. mesiana*, *E. superbidens*, *E. xystriformis*, *E. zygodon* var. *gracilis*.
- ✓ Considerando os três hábitats avaliados, o gênero *Eunotia* foi mais bem representado na comunidade dos sedimentos superficias (57 táxons) e do perifíton (53 táxons) e menos representado no fitoplâncton (48 táxons). Considerando o número de amostras analisadas para cada comunidade, o gênero manteve-se mais bem representado no sedimento e perifíton.
- ✓ Na área de estudo, a espécie com a maior frequência de ocorrência nas estações de amostragem (68%) foi *Eunotia* sp. nov. 8, seguida de *E. juettnerae* (53%) e *E. pseudosudetica* (33%). Em relação à abundância máxima, duas espécies se destacaram, *E. incisa* e *E. waimiriorum*, as quais atingiram abundâcias de 53.1% e 69.5%, respectivamente.
- ✓ A preferência ecológica de 19 espécies foi avaliada conforme o critério de corte estabelecido de frequência de ocorrência $\geq$ 10% nos diferentes hábitats. Em relação aos nutrientes, a maioria dos táxons (17) apresentou seus ótimos ecológicos distribuídos no intervalo de concentração de fósforo total referente a ambientes ultraoligo- a mesotróficos (5.2-52 µg L^{-1}). Da mesma forma, o ótimo para condutividade ocorreu principalmente em valores baixos (< 90 µS cm^{-1}) e em águas ácidas a ligeiramente ácidas (ótimo de pH entre 5.5-6.9), que são indicativos de ambientes mais protegidos.
- ✓ Apenas duas espécies, *E. rhomboidea* e *Eunotia* sp. nov. 3, ocorreram preferencialmente em ambientes eutróficos. Apresentaram elevados valores de ótimos ecológicos para fósforo total (57-66.5 µg L^{-1}), condutividade (108-172 µS cm^{-1}) e pH (7.3-7.7), sendo muito provavelmente indicadoras de ambientes degradados.
- ✓ O conjunto dos resultados confirma a preferência do gênero *Eunotia* por águas mais limpas, ácidas a levemente ácidas. Todavia, pela primeira vez é documentada a preferência de duas espécies indicadoras de condições mais degradadas.
- ✓ Destaca-se o uso da microscopia eletrônica de varredura para o aprofundamento do conhecimento das espécies de *Eunotia*, além de sua importância na identificação de algumas

espécies. Como exemplo, *Eunotia* sp. nov. 1, por apresentar diversas características morfológicas de *Fragilaria* em microscopia de luz, só pôde ser confirmada como pertencente ao gênero *Eunotia* com a utilização do MEV para melhor observação de suas estruturas, principalmente da rafe. Ainda, algumas espécies foram ilustradas pela primeira vez nesse tipo de microscopia.

- ✓ A partir da integração de informações taxonômicas e ecológicas das espécies do gênero *Eunotia*, este estudo contribui, com bases mais consistentes, para o melhor conhecimento das populações tropicais e de seu uso na bioindicação.

ANEXO 1

LISTAGEM DOS TÁXONS COM SUAS RESPECTIVAS AUTORIAS E CÓDIGOS

Anexo 1. Códigos dos táxons de *Eunotia* conforme o programa OMNIDIA e suas respectivas autorias.

Código	Táxon
EBIC	*Eunotia bicornigera* Metzeltin & Lange-Bertalot
EUBI	*Eunotia bidens* Ehrenberg
EBLU	*Eunotia bilunaris* (Ehrenberg) Schaarschmidt
ECAM	*Eunotia camelus* Ehrenberg
EDFC	*Eunotia deficiens* Metzeltin, Lange-Bertalot & García-Rodríguez
EDMG	*Eunotia desmogonioides* Metzeltin & Lange-Bertalot
EDID	*Eunotia didyma* Lange-Bertalot
EFAO	*Eunotia fallacoides* Lange-Bertalot & Cantonati
EFOR	*Eunotia formica* Ehrenberg
EFOM	*Eunotia formicina* Lange-Bertalot
EFUH	*Eunotia fuhrmannii* Metzeltin & Tremarin
EGEN	*Eunotia genuflexa* Nörpel-Schempp
EGEO	*Eunotia georgii* Metzeltin & Lange-Bertalot
EHEZ	*Eunotia herzogii* Krasske
EUIB	*Eunotia ibitipocaensis* L.C.G. Canani & L.C. Torgan
EIMP	*Eunotia implicata* Nörpel, Alles & Lange-Bertalot
EINC	*Eunotia incisa* Gregory
EICS	*Eunotia incisatula* Metzeltin & Lange-Bertalot
EITC	*Eunotia intricans* Lange-Bertalot & Metzeltin
EJUE	*Eunotia juettnerae* Lange-Bertalot
EKAR	*Eunotia karenae* Metzeltin & Lange-Bertalot
EKRU	*Eunotia kruegeri* Lange-Bertalot
ELGC	*Eunotia longicollis* Metzeltin & Lange-Bertalot
EMER	*Eunotia meridiana* Metzeltin & Lange-Bertalot
EMES	*Eunotia mesiana* Cholnoky
EMON	*Eunotia monodon* Ehrenberg
EMUC	*Eunotia mucophila* (Lange-Bertalot & Nörpel-Schempp) Lange-Bertalot
EMUS	*Eunotia muscicola* Krasske
ENAE	*Eunotia naegelii* Migula
ENMD	*Eunotia neomundana* Metzeltin & Lange-Bertalot
DOSI	*Desmogonium ossiculum* Metzeltin & Lange-Bertalot
EUPA	*Eunotia paludosa* Grunow
EPAP	*Eunotia papilio* (Ehrenberg) Grunow
EPAS	*Eunotia parasiolii* Metzeltin & Lange-Bertalot
EPLV	*Eunotia paulovalida* Metzeltin & Lange-Bertalot
EPRA	*Eunotia praerupta* Ehrenberg
EPDI	*Eunotia pseudoindica* Frenguelli
EPSD	*Eunotia pseudosudetica* Metzeltin, Lange-Bertalot & García-Rodríguez
EPCA	*Eunotia pyramidata* var. *pryramidata* f. *capitata* Krasske
EPYM	*Eunotia pyramidata* var. *monodon* Krasske
ERMO	*Eunotia rabenhorstii* var. *monodon* Cleve & Grunow
ERBT	*Eunotia rabenhorstii* var. *triodon* Cleve & Grunow

Anexo 1. Cont.

Código	Táxon
ERHO	*Eunotia rhomboidea* Hustedt
ERSC	*Eunotia roland-schmidtii* Metzeltin & Lange-Bertalot
ESHD	*Eunotia schneideri* Metzeltin & Lange-Bertalot
ESUB	*Eunotia subarcuatoides* Alles, Nörpel & Lange-Bertalot
ESUD	*Eunotia sudetica* O. Müller
ESPB	*Eunotia superbidens* Lange-Bertalot
ETEC	*Eunotia tecta* Krasske
ETFG	*Eunotia transfuga* Metzeltin & Lange-Bertalot
ETRI	*Eunotia tridentula* Ehrenberg
ETGB	*Eunotia trigibba* Hustedt
ETUK	*Eunotia tukanorum* C.E. Wetzel & D.C. Bicudo
EVAL	*Eunotia valida* Hustedt
EVEN	*Eunotia veneris* (Kützing) De Toni
EVIX	*Eunotia vixexigua* Metzeltin & Lange-Bertalot
EWAI	*Eunotia waimiriorum* C.E. Wetzel
EXYS	*Eunotia xystriformis* Manguin
EYAN	*Eunotia yanomami* Metzeltin & Lange-Bertalot
EYBE	*Eunotia yberai* Frenguelli
EZYG	*Eunotia zygodon* var. *zygodon* Ehrenberg
EZGR	*Eunotia zygodon* var. *gracilis* Hustedt
ESN1	*Eunotia* sp. nov. 1
ESN2	*Eunotia* sp. nov. 2
ESN3	*Eunotia* sp. nov. 3
ESN4	*Eunotia* sp. nov. 4
ESN6	*Eunotia* sp. nov. 6
ESN7	*Eunotia* sp. nov. 7
ESN8	*Eunotia* sp. nov. 8
ESN9	*Eunotia* sp. nov. 9
ESN10	*Eunotia* sp. nov. 10
ESN11	*Eunotia* sp. nov. 11
ESN12	*Eunotia* sp. nov. 12
ESP1	*Eunotia* sp. 1
ESP2	*Eunotia* sp. 2
ESP3	*Eunotia* sp. 3
ESP4	*Eunotia* sp. 4
ESP5	*Eunotia* sp. 5
ESP6	*Eunotia* sp. 6
ESP7	*Eunotia* sp. 7
ESP8	*Eunotia* sp. 8
ESP9	*Eunotia* sp. 9
ESP10	*Eunotia* sp. 10
ESP11	*Eunotia* sp. 11
ESP12	*Eunotia* sp. 12

ANEXO 2

ÓTIMO ECOLÓGICO DAS ESPÉCIES DE *EUNOTIA*

Anexo 2. Ótimo ecológico das espécies de *Eunotia* com ocorrência maior ou igual a 10% em cada hábitat. F: fitoplâncton, P: perifíton, S: sedimento superficial.

Código	Ótimo para pH			Ótimo para condutividade (µS cm^{-1})			Ótimo para PT (µg L^{-1})			Ótimo para NT (µg L^{-1})		
	F	P	S	F	P	S	F	P	S	F	P	S
EBLU	-	6,6	-	-	90	-	-	37,2	-	-	818,9	-
EDMG	6,9	7,2	6,5	73	45	35	43,2	14,2	14,8	697,0	368,5	443,1
EGEN	-	6,3	-	-	48	-	-	13,2	-	-	410,3	-
EICS	-	-	5,9	-	-	20	-	-	9,7	-	-	335,0
EITC	7,0	6,4	6,8	81	56	66	44,0	17,9	31,5	1.039,6	319,8	540,0
EJUE	6,4	6,6	6,2	45	52	26	32,2	23,9	16,2	536,4	533,9	401,2
EKRU	-	6,8	-	-	30	-	-	14,9	-	-	466,6	-
EMER	7,1	-	7,0	82	-	67	43,5	-	35,5	836,9	-	672,0
EMUS	-	6,8	6,2	-	31	15	-	14,8	14,0	-	452,5	174,5
EPSD	6,8	6,9	6,9	67	62	49	75,2	17,7	26,1	718,1	416,0	639,8
ERHO	-	7,3	-	-	108	-	-	57,0	-	-	864,9	-
EVEN	-	5,5	5,5	-	22	19	-	7,2	5,8	-	398,0	316,2
EWAI	6,4	-	6,9	41	-	56	25,2	-	37,3	394,6	-	736,6
ESN2	-	6,5	-	-	29	-	-	16,6	-	-	483,8	-
ESN3	-	7,7	-	-	172	-	-	66,5	-	-	1.416,3	-
ESN8	6,6	6,3	6,3	52	22	30	28,9	10,8	16,0	632,0	305,4	448,2
ESN10	6,7	6,6	6,7	44	71	63	20,4	34,2	25,4	562,5	862,7	609,1
ESP5	-	-	5,7	-	-	12	-	-	5,4	-	-	362,1
ESP7	6,3	-	-	47	-	-	31,6	-	-	473,5	-	-