MARCUS RODRIGO GUIDOTI SOARES

ANÁLISE FILOGENÉTICA E REVISÃO DE *SPHAEROCYSTA* (HEMIPTERA, HETEROPTERA, TINGIDAE)

Dissertação apresentada ao Programa de Pós-Graduação em Biologia Animal, Instituto de Biociências da Universidade Federal do Rio Grande do Sul, como requisito parcial à obtenção do título de Mestre em Biologia Animal.

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Orientador: Dr. Augusto Ferrari
Co-orientadora: Dra. Aline Barcellos

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“Análise filogenética e revisão de *Sphaerocysta* (hemiptera, heteroptera, tingidae)”

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Prof. Dr. Luiz Alexandre Campos

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Dra. Caroline Greve

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Prof. Dr. Cristiano Schwertner

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Sumário

Capítulo 1. *Sphaerocysta costai* n. sp. (Heteroptera: Tingidae): new light on the evolutionary trends of Tingidae morphology

Capítulo 2. Phylogenetic analysis and taxonomic revision of the Neotropical lacebug genus *Sphaerocysta* (Heteroptera: Tingidae), with the description of a new species

Resumo

O gênero de percevejo de renda *Sphaerocysta* (Heteroptera, Tingidae), é composto por 12 espécies com distribuição exclusiva para a América do Sul, sendo que apenas *S. nosella* não é registrada para o Brasil. Ele pode ser caracterizado por: capuz esférico; presença de carenas pronotais (uma ou três); cisto na projeção posterior do pronoto (com exceção de *S. egregia*); área discoidal com a parte posterior elevada. Somente duas espécies possuem informações sobre imaturos, *S. angulata* e *S. inflata*, e somente o quinto ínstar destes táxons foram descritos. O histórico taxonômico do gênero não possui muitos atos nomenclaturais, contando com apenas 4 sinonímias. Duas novas espécies foram aqui propostas, *S. ruthae* n. sp. e *S. costai* n. sp., sendo a última descrita junto com sua ninfa de quinto ínstar. As informações dos imaturos das espécies de *Sphaerocysta* foram adicionadas a uma matriz morfológica previamente publicada (Guilbert, 2004), para o teste das hipóteses de evolução de caracteres ninfais propostas pelo autor da matriz. Com a adição destes novos táxons à matriz, as hipóteses defendidas na literatura não foram corroboradas. A marcante diferença intragenérica observada na morfologia das ninfas de quinto ínstar das espécies de *Sphaerocysta*, após a descrição do imaturo de *S. costai* n. sp., foi jamais observada em outro gênero da família. A análise filogenética do gênero recuperou a monofilia do mesmo, sendo este grupo irmão de *Dicysta*, um gênero majoritariamente Neotropical. O grupo irmão de ambos foi *Galeatus spinifrons*, uma espécie Paleártica. A revisão taxonônima resultou na proposição de uma sinonimia (*S. maculata* como sinônimo júnior de *S. propria*), com discussão sobre o status taxonômico de *S. propria* e *S. brasiliensis*, e também *S. globifera* e *S. stali*. Os novos dados de ocorrência reportados no trabalho permitiram a expansão do registro geográfico do gênero para a América Central (*S. fumosa*, registrado pela primeira vez no Panamá) e computou novos registros para cinco espécies, sendo elas: *S. angulata*, *S. fumosa*, *S. globifera*, *S. inflata* e *S. nosella*. *Sphaerocysta fumosa* e *S. nosella* tiveram primeiros registros para, respectivamente: Panamá e Venezuela; Brasil. Com este novo dado geográfico de *S. nosella*, todas as espécies do gênero ocorrem no Brasil, com exceção de *S. costai* n. sp., exclusiva da Argentina.

Abstract

The lacebug genus *Sphaerocysta* (Heteroptera, Tingidae comprises twelve species, exclusive to South America, all registered to Brazil with the exception of *S. nosella*. *Sphaerocysta* can be identified by the following characters: spherical hood; presence of pronotal carina (one or three); presence of a cyst on the pronotal posterior projetion (except *S. egregia*); posterior region of discoidal area elevated. Immatures were described for only two species, *S. angulata* and *S. inflata*, both fifth instar nymphs. The taxonomic history has only a few taxonomic acts, including four synonymies. Two new species are here described: *S. ruthae* n. sp. e *S. costai* n. sp., the last described together with its fifth instar nymph. These immature data of the species of Sphaerocysta were added to a matrix used in a phylogenetic analysis (Guilbert, 2004), to test the hypoteses regarding the evolution of the morphological immature features proposed by the matrix author. The analyses after the addition of these new data do not corroborate with those hypotheses. The remarkable morphological difference observed within the *Sphaerocysta* immatures described so far was never noticed in any other Tingidae genera. The phylogenetic analysis recovered the genus as monophyletic, with *Dicysta*, a mostly Neotropical genus, as its sister-group. The sister-group of this clade was *Galeatus spinifrons*, a Paleartic species. The taxonomic review led to a synonomy: *S. maculata* is now considered junior synonym of *S. propria*. Besides this nomenclatural act, comments on the status of *S. propria* and *S. brasiliensis*, as well as on the status of *S. globifera* and

S. *stali* are available. The new geographical data presented in this work expands the distributional range of the genus to the Central America (*S*. *fumosa*, reported for the first time in Panama). A total of five species have new distributional records: *S*. *angulata*, *S*. *fumosa*, *S*. *globifera*, *S*. *inflata* and *S*. *nosella*. *Sphaerocysta fumosa* and *S*. *nosella* have some first country records, as follows: Panama and Venezuela; Brazil, respectively. With this new geographical data of *S*. *nosella*, all the species of *Sphaerocysta* occur in Brazil, with the only exception of *S*. *costai* n. sp., exclusive to Argentina.

Introdução Geral

Tingidae (Hemiptera: Heteroptera)

Tingidae é uma família de insetos fitófagos pequenos, com no máximo 5 mm de comprimento, composta por cerca de 2100 espécies divididas em cerca de 300 gêneros (Froeschner, 1996). De distribuição cosmopolita, ocorrem em todos os continentes, incluindo ilhas oceânicas (Drake & Ruhoff, 1960). Na região neotropical, estima-se cerca de 500 espécies distribuídas em 75 gêneros. Os tingídeos possuem uma morfologia marcante, com um aspecto rendado do paranoto e dos hemiélitros, o que lhes confere o nome popular de percevejos de renda (Drake & Ruhoff, 1965). Devido a estes traços morfológicos evidentes, a taxonomia e a classificação do grupo tem se baseado exclusivamente em caracteres morfológicos externos.

Geralmente encontrados na face abaxial das folhas de suas plantas hospedeiras, os percevejos de renda podem ocorrer em espécies botânicas das mais diversas ordens e hábitos, podendo também estar associados a raízes, caule, flores e frutos (Drake & Ruhoff, 1965). Esta é a única família de Heteroptera capaz de formar galhas, característica observada nos gêneros *Copium* Thunberg, 1822 e *Paracopium* Distant, 1902 (Schaefer, 2003). Existem quatro tipos de comportamento de cuidado maternal, reportados até hoje nos gêneros *Compseuta* Stål, 1873, *Corythucha* Stål, 1873, *Gargaphia* Stål, 1873 e *Leptobyrsa* Stål, 1873 (Guidoti, Tallamy & Marsaro Júnior, in prep). Há ainda formas mirmecófilas, que vivem em ninhos de formigas alimentando-se possivelmente de raízes vegetais, e que apresentam certo mimetismo morfológico e comportamental com estes himenópteros (China, 1945; Kormilev, 1955a; Drake & Froeschner, 1962; Doesburg, 1977). Algumas espécies são consideradas pragas agrícolas, como os tingídeos que ocorrem nas plantações de cacau, soja e milho (Neal & Schaefer, 2000).

Classificação e Filogenias

Historicamente, a composição de subfamílias de Tingidae tem sido matéria de discussão entre os especialistas. A proposta atualmente mais aceita foi a de Drake & Ruhoff (1960) que dividia a família em três subfamílias, sendo elas: Cantacaderinae, Tinginae e Vianaidinae. Cantacaderinae e Tinginae foram ainda divididas nas tribos Cantacaderini e Phatnomatini; Tingini, Ypsotingini e Litadeini, respectivamente. Os cantacaderíneos foram considerados como os mais primitivos, devido a morfologia dita simples do hemiélitro e pronoto (Drake & Ruhoff, 1960). Os vianaidíneos agrupavam as formas mirmecófilas e coleopteroides, e alguns autores consideram essa subfamília com o *status* de família (Lis, 1999; Golub, 2001; Golub & Popov, 2003; Montemayor & Carpintero, 2007). Os tingíneos comportam, por sua vez, a maior diversidade do grupo (cerca de 90% – Drake & Ruhoff, 1965).

Análises filogenéticas no grupo são raras. Lis (1999) testou a monofilia de Cantacaderinae e propôs algumas alterações na classificação, como a elevação do grupo ao *status* de família (bem como Vianaidinae), a transferência de Phatnomatini para Tinginae, e também a criação de Carldrakeaninae como uma subfamília de Cantacaderidae *stat. nov.* e de Ceratocaderini como tribo de Cantacaderinae *stat. nov*. Esta análise, bem como as decisões taxonômicas consequentes, foram criticadas por Schuh, Cassis & Guilbert (2006). Nesta contribuição, os autores questionam a abordagem filogenética utilizada por Lis (1999), que incluiu táxons supragenéricos como terminais, e alegam que a elevação do ranking de um determinado grupo taxonômico (como por exemplo, Vianaidinae e Cantacaderinae) poderia tornar as hipóteses de relação entre os mesmos mais obscuras, e que por isso, não havia necessidade de serem aceitas. Guilbert (2012) reanalisou a matriz de Lis (1999) e recuperou a monofilia dos táxons propostos, entretanto, com relações conflitantes entre Carldrakeaninae, Ceratocaderini e Cantacaderinae. No entanto, Guilbert (2012) não elevou Carldrakeaninae a subfamília como havia proposto Lis (1999). No nível genérico, as análises filogenéticas são mais raras ainda (por exemplo, Guilbert, 2000; Cassis & Symonds, 2011). Montemayor & Costa (2009), foram os únicos a testar a monofilia de gêneros neotropicais com uma metodologia filogenética cladista.

Importância do Estudo dos Imaturos

A importância do estudo dos imaturos para identificação e classificação dos táxons é amplamente reconhecida. Os imaturos de Tingidae apresentam estruturas marcadamente conspícuas (tubérculos) na cabeça, no dorso de alguns segmentos torácicos e abdominais e na lateral de todos os segmentos (Livingstone, 1978; Guilbert, 2004; Guidoti & Barcellos, 2013). Algumas destas estruturas podem secretar substâncias defensivas (Mason *et al*., 1991) e ferormônios que auxiliam na regulação dos complexos comportamentos parentais descritos para alguns táxons da família (Parr *et al*., 2002). Estas estruturas também possuem relevância taxonômica, apesar de haver poucos gêneros com imaturos descritos (Guilbert, 2004), principalmente na região Neotropical (Guidoti & Barcellos, 2013). Para o gênero *Tingis* Fabricius, 1803, por exemplo, há uma chave de identificação disponível baseada em caracteres ninfais (Péricart, 1981). Para o gênero *Sphaerocysta* Stål, 1873, somente em uma contribuição recente, ninfas de duas espécies foram representadas e descritas (Guilbert & Montemayor, 2010). As ninfas descritas eram do quinto ínstar das espécies *Sphaerocysta inflata* (Stål, 1858) e *S. angulata* Monte, 1941 e apresentam diferenças marcantes que permitem uma fácil identificação destas espécies com base nos imaturos.

O gênero *Sphaerocysta*

O gênero *Sphaerocysta* (Tingini) foi originalmente proposto para abrigar duas espécies anteriormente descritas para o gênero *Tingis*, a saber *T. inflata* e *T. globifera* (Stål, 1858). É composto atualmente por 12 espécies, todas neotropicais, registradas exclusivamente em plantas hospedeiras da família Bignoniaceae (Drake & Ruhoff, 1965). O gênero é caracterizado pelos seguintes caracteres: capuz esférico; presença de carenas pronotais (uma ou três); cisto na projeção posterior do pronoto (com exceção de *S. egregia* Drake, 1928); área discoidal com a parte posterior elevada. Os principais caracteres apontados na literatura para diagnose diferencial das espécies de *Sphaerocysta* são: número de carenas no pronoto; desenvolvimento da carena média do pronoto; desenvolvimento do cisto na projeção posterior do pronoto; forma e tamanho do paranoto; número de linhas de células no paranoto; largura e número de linhas de células da área costal do hemiélitro (Stål, 1873; Drake, 1928, 1939; Drake & Poor, 1939; Monte, 1939a, 1941, 1942; Drake & Hambleton, 1945).

O histórico taxonômico do gênero contém poucos casos de sinonímia e de equívocos taxonômicos. *Sphaerocysta inflata*, assim como *S. globifera* (Stål, 1858), foi originalmente descrita para o gênero *Tingis* Fabricius (Stål, 1858), sendo esta combinação citada por Walker (1873). Stål (1873), transferiu estas duas espécies para *Sphaerocysta*, ao descrever o gênero. *Sphaerocysta peckami* Ashmead, 1887 foi descrita e posteriormente transferida para o gênero *Galeatus* (Van Duzee, 1889), e então, mais tarde, sinonimizada com *Galeatus angusticollis* Jakovlev, 1880 (Drake & Ruhoff, 1962), sendo esta considerada sinônimo júnior de *Galeatus spinifrons* (Fallén, 1807) (Drake & Ruhoff, 1965). O gênero *Galeatus* não compartilha nenhuma das características marcantes do gênero *Sphaerocysta*, e a descrição realizada por Ashmead pode ser considerada um erro. *Sphaerocysta biseriata* Drake, 1928 foi primeiramente descrita como uma variedade de *S. inflata* (*S. inflata* var. *biseriata* em Drake, 1928). Drake & Hambleton (1934) elevaram *S. biseriata* à espécie. Segundo Drake (1928), Stål identificou alguns espécimes como *S. globifera* que seriam posteriormente descritos como *S. stali* Drake, 1928. Champion (1898), por sua vez, ao desenhar um espécime de *S. globifera*, ilustrou na verdade um indivíduo de *S. stali* (Drake, 1928), da série equivocadamente determinada por Stål. Assim, Drake & Ruhoff (1965) consideraram a *S. globifera* ilustrada por Champion (1898) como *S. stali*. *Sphaerocysta paris* Drake, 1939 foi considerada o sinônimo sênior de *S. romani* Drake, 1947 (Drake & Ruhoff, 1961).

Atualmente, o gênero é composto por 12 espécies, sendo que 11 possuem registro para o Brasil: *S. angulata*; *S. biseriata*; *S. brasiliensis* Monte, 1938; *S. egregia*; *S. fumosa* Drake, 1928; *S. globifera*; *S. inflata*; *S. maculata* Monte, 1942; *S. paris*; *S. propria* Drake & Poor, 1939 e *S. stali*. *Sphaerocysta nosella* Drake & Hambleton, 1945, descrita para espécimes coletados em Vinces, no Equador, não possui registro para o Brasil. *Sphaerocysta globifera* e *S. inflata* também são citadas para outros países (respectivamente: Paraguai; Bolívia, Argentina e Paraguai).

De forma geral, *Sphaerocysta* é citado na literatura apenas em catálogos e listas ou com curtas observações taxonômicas (Lethierry & Severin, 1896; Drake, 1929, 1930a, 1930b, 1935, 1936; Drake & Bondar, 1932; Costa Lima, 1936, 1940; Drake & Poor, 1937; Monte, 1938, 1939b, 1940; Kormilev, 1955b; Silva, 1956; Drake & Ruhoff, 1960; Drake & Davis, 1960). Até o momento nenhuma revisão taxonômica foi realizada e não há hipóteses filogenéticas para as relações entre as espécies do gênero, tampouco espécies de *Sphaerocysta* foram incluídas nas filogenias de Tingidae conduzidas até então (por exemplo, Lis, 1999; Guilbert, 2001, 2004, 2012; Schuh *et al.*, 2006). Também não há na literatura informações sobre a biologia, ecologia ou etologia das espécies deste gênero. Como mencionado previamente, as formas imaturas do gênero também são pouco conhecidas (Guilbert & Montemayor, 2010).

Considerando que o gênero foi proposto há mais de 125 anos, e que não foi revisto taxonomicamente, esta sistematização do conhecimento sobre o gênero se faz necessária, assim como para que o status taxonômico das espécies propostas sejam revistos. Também há a necessidade de que se teste a hipótese de monofilia do táxon, bem como se estabeleça uma hipótese de relacionamento entre suas espécies. Dessa forma, a realização de uma revisão taxonômica e de uma análise filogenética para o gênero *Sphaerocysta* visa contribuir para o conhecimento do táxon, e também, fornecer caracteres utilizáveis em futuras análises cladísticas de Tingidae em nível genérico e supragenérico.

Objetivos

O objetivo geral deste trabalho foi o de testar a monofilia do gênero *Sphaerocysta* e propor uma hipótese para as relações de parentesco entre as suas espécies, utilizando a metodologia cladística. Objetivos específicos: 1) realizar a revisão taxonômica do gênero; 2) redescrever as espécies; 3) descrever potenciais novos táxons; 4) estabelecer a diagnose diferencial das espécies; 5) fornecer chave de identificação para as espécies do gênero; 6) elaborar mapas de distribuição atualizados para as espécies do gênero.

Material & Métodos

Organização da Dissertação

A dissertação está organizada em três diferentes partes. A primeira corresponde a introdução geral, composta por uma revisão da literatura e por uma síntese dos objetivos, resultados e conclusões gerais. Os capítulos 1 e 2 correspondem aos trabalhos desenvolvidos, redigidos na forma de artigos científicos, de acordo com as normas das revistas European Journal of Entomology (Anexo I) e Zoological Journal of the Linnean Society (ZJLS, Anexo II), respectivamente. O capítulo 1 já foi submetido para a publicação e as referências da primeira parte foram formatadas de acordo com as normas da ZJLS.

Desenvolvimento do Trabalho

Os espécimes estudados pertencem a 19 instituições de pesquisa e coleções científicas nacionais e internacionais, sendo a maior parte do material analisado em visitação às respectivas instituições (Anexo III). Material-tipo de todas as espécies do gênero foi estudado, com exceção de *Sphaerocysta globifera* e *S. inflata*, que foram examinados através de fotografias em alta resolução enviadas pela instituição que os detém. As duas novas espécies descritas foram depositadas nos museus de origem dos respectivos espécimes, sendo *S.* c*ostai* n. sp. proveniente do Museo de La Plata (La Plata, Argentina) e Muséum National d'Histoire Naturelle (Paris, França) e *S. ruthae* n. sp. do American Museum of Natural History (Nova Iorque, Estados Unidos). Fotografias foram obtidas através de uma câmera digital (Cannon Powershot a520) acoplada a estereomicroscópio. Medidas foram obtidas através de duas metodologias distintas: lente milimetrada acoplada ao estereomicroscópio e através de fotografias. Desenhos foram realizados também com o auxílio de fotografias, diretamente no computador, em formato vetorial. A terminologia aplicada nas descrições, diagnose e chaves de identificação segue Drake & Davis (1960). As chaves de identificação foram construídas sem auxílio de softwares, após estudo das descrições originais e do material-tipo.

A análise filogenética do capítulo 1 foi baseada na matriz de caracteres de Guilbert (2004). Esta matriz compreendia 61 caracteres (34 ninfais e 27 de morfologia de adultos) e 33 táxons. *Sphaerocysta costai* n. sp., *S. angulata* e *S. inflata* foram incluídas nesta matriz, totalizando 36 táxons na análise. Todas as buscas foram realizadas repetindo os parâmetros utilizados por Guilbert (2004), e com o mesmo software (Nona, versão 2.0 – Goloboff, 1998). Bremer absoluto foi utilizado como medida de suporte, e obtido com o TNT (Goloboff, Farris & Nixon, 2008), mantendo árvores com 10 passos extras. Para testar o efeito na topologia dos diferentes conjuntos de dados e para prover alguma hipótese filogenética do gênero, estes conjuntos também foram analisados individualmente, seguindo a mesma estratégia e os mesmos parâmetros.

A análise do capítulo 2 foi conduzida a partir de uma matriz de 31 táxons e 84 caracteres, sendo estes, 19 de cabeça, 62 de tórax (18 de hemiélitro) e 3 de abdômen. Todos os caracteres foram considerados não ordenados e de pesos iguais. A análise foi conduzida com auxílio do software TNT (Goloboff *et al.*, 2008). Bremer absoluto, e Jacknife absoluto e relativo foram utilizados como medidas de suporte e calculados no TNT. Winclada (Nixon, 2002) foi utilizado para extrair o arquivo de imagem da árvore filogenética. Os grupos externos foram escolhidos a partir dos seguintes critérios: 1) similaridade morfológica; 2) histórico taxonômico; 3) disponibilidade de material. Os enunciados dos caracteres foram elaborados seguindo Sereno (2007), e apenas 11 caracteres foram extraídos da literatura (Lis, 1999; Guilbert, 2000, 2001, 2004; Montemayor & Costa, 2009; Cassis & Symonds, 2011).

Resumo dos Resultados

Duas novas espécies foram descritas, *Sphaerocysta costai* n. sp. Guidoti & Montemayor e *S. ruthae* n. sp. Guidoti. A primeira foi descrita a partir de material proveniente das províncias de Salta e Jujuy, na Argentina. Morfologicamente assemelha-se a *S. angulata*, por possuir o ângulo posterior do pronoto em forma de triângulo, mas difere-se no desenvolvimento deste mesmo caráter (mais acentuado em *S. costai*), assim como na espessura da carena média e mais marcadamente na morfologia dos imaturos. *Sphaerocysta ruthae*, por sua vez, é a única espécie do gênero que possui o capuz ovalado e não esférico. A espécie foi descrita a partir de um espécime de Minas Gerais, Brasil, e assemelha-se a *S. inflata* e *S. biseriata*, devido ao paranoto biseriado, com as células externas conspicuamente maiores que as internas, e pelas carenas pronotais e formato do hemiélitro.

Diversos novos registros foram descobertos. *Sphaerocysta angulata* foi registrada pela primeira vez na província de Salta, na Argentina. *Sphaerocysta fumosa* teve dois registros novos para países (Panamá e Venezuela), enquanto *S. nosella* foi registrada pela primeira vez no Brasil e *S. globifera* na Argentina. Com este novo registro de *S. nosella*, todas as espécies descritas para o gênero possuem registro para o Brasil, com exceção de *S. costai* n. sp., exclusiva da Argentina. *Sphaerocysta globifera*, *S. inflata* e *S. propria* tiveram novos registros para estados brasileiros, sendo eles, respectivamente: Paraná e Santa Catarina; Goiás, Paraná e Rio Grande do Sul; Paraná e São Paulo. Além disso, *S. globifera* também foi registrada pela primeira vez na província de Missiones, na Argentina.

Na análise filogenética do primeiro capítulo, a matriz publicada por Guilbert (2004) foi reanalisada após a inclusão de três novos táxons (*Sphaerocysta angulata*, *S. costai* n. sp. e *S. inflata*). Neste trabalho, Guilbert discutiu a hipótese evolutiva de que as ninfas de Tingidae teriam evoluído de uma morfologia mais simples para uma mais complexa, o que não foi recuperado após a inclusão das espécies de *Sphaerocysta*. Além disso, *S. costai* n. sp. não apresenta os tubérculos laterais do tórax e abdômen observados nas demais espécies do gênero. Esta foi a primeira vez que uma diferença intragenérica marcante da morfologia de imaturos foi descrita para a família. A análise exclusiva do conjunto de caracteres de adultos revelou uma relação não monofilética das espécies do gênero. Porém, este resultado não foi amplamente discutido uma vez que a análise não havia sido desenhada para o teste da monofilia do gênero.

No segundo capítulo, a revisão do gênero foi conduzida e uma sinonímia foi proposta. Todas as espécies foram redescritas, e duas outras possíveis sinonímias, a espera de novas evidências, foram discutidas. A análise filogenética resultou em uma única árvore mais parcimoniosa que corroborou a hipótese de monofilia do gênero. Dentro de *Sphaerocysta*, dois clados foram bem suportados: *S. propria* e *S. brasiliensis*, como grupo irmão de *S. globifera* e *S. stali*. O grupo-irmão de *Sphaerocysta* foi *Dicysta* Champion, 1897.

Referências

Cassis G, Symonds C. 2011. Systematics, biogeography and host plant associations of the lace bug genus *Lasiacantha* Stål in Australia (Insecta: Hemiptera: Heteroptera: Tingidae). *Zootaxa* 2818: 1-63.

Champion GC. 1898. Notes on American and other Tingitidae, with Descriptions of two new Genera and four Species. *Transactions of the Royal Entomological Society of London* 46(1): 55-64.

China WE. 1945. A completely blind bug of the family Lygaeidae (Hemiptera-Heteroptera). *Proceedings of the Royal Entomological Society of London* 14(9-10): 126-128.

Costa Lima AM. 1936. *Terceiro catalogo dos insectos que vivem nas plantas do Brasil. Terceiro catalogo dos insectos que vivem nas plantas do Brasil*. Ministerio da Agricultura do Brasil, Departamento Nacional da Produção Vegetal, Escola Nacional de Agronomia.

Costa Lima AM. 1940. Insetos do Brasil: Segundo Tomo - Hemípteros. *Escola Nacional de Agronomia, Série Didatica* 3: 1-351.

Doesburg PH. 1977. A New Species of *Thaumamannia* from Surinam (Heteroptera, Tingidae, Vianaidinae). *Zoologische Mededelingen* 52(14): 187-189.

Drake CJ. 1928. New and Little Known Neotropical Tingitidae. *Iowa State College Journal of Science* 3(1): 41-56.

Drake CJ. 1929. Some Tingitoidea from Central and South America. *Bulletin of the Brooklyn Entomological Society* 24(1): 35-37.

Drake CJ. 1930a. Some Tingitidae from Brazil (Hemiptera). *Bulletin of the Brooklyn Entomological Society* 25(1): 25-26.

Drake CJ. 1930b. Some Tingitidae (Hemiptera) from Brazil. *American Museum Novitates* (398): 1-3.

Drake CJ. 1935. American Tingitoidea (Hemiptera) in the Natural History Museum of Vienna. *Konowia* 14: 9-20.

Drake CJ. 1936. Some Tingitoidea from Argentina (Hemiptera). *Travaux de l' Institut Zoologique de l' Academie des Sciences de l' URSS* 3: 699-701.

Drake CJ. 1939. Seven New South American Tingitidae (Hemiptera). *Revista de Entomologia* 10(3): 525-530.

Drake CJ, Bondar G. 1932. Concerning Brazilian Tingitidae - Hemiptera. *Boletim do Museu Nacional* 8: 87-96.

Drake CJ, Davis NT. 1960. The Morphology, Phylogeny, and Higher Classification of the Family Tingidae, Including the Description of a New Genus and Species of the Subfamily Vianaidinae (Hemiptera: Heteroptera). *Entomologica Americana* 39: 1-100.

Drake CJ, Froeschner RC. 1962. A New Myrmecophilous Lacebug from Panama (Hemiptera: Tingidae). *The Great Basin Naturalist* 22(1-3): 8-11.

Drake CJ, Hambleton EJ. 1934. Brazilian Tingitidae (Hemiptera) (Part I). *Revista de*

Entomologia 4(4): 435-451.

Drake CJ, Hambleton EJ. 1945. Concerning Neotropical Tingitidae (Hemiptera). *Journal of the Washington Academy of Sciences* 35(11): 356-367.

Drake CJ, Poor ME. 1937. The South American Tingitidae (Hemiptera) Described by Stål. *Memoirs of the Carnegie Museum* 11(5): 301-312.

Drake CJ, Poor ME. 1939. Seven New American Tingitidae (Hemiptera). *Bulletin of the Brooklyn Entomological Society* 34(1): 31-35.

Drake CJ, Ruhoff FA. 1960. Lace-bug genera of the world. (Hemiptera: Tingidae). *Proceedings of the United States National Museum* 112: 1-105.

Drake CJ, Ruhoff FA. 1961. New Species and Taxonomic Changes in the Tingidae (Hemiptera). *Journal of Kansas Entomological Society* 34(3): 145-151.

Drake CJ, Ruhoff FA. 1962. Synonymic notes and descriptions of new Tingidae (Hemiptera). *Studia Entomologica* 5(1-4): 489-506.

Drake CJ, Ruhoff FA. 1965. Lacebugs of the World: A Catalog (Hemiptera: Tingidae). *United States National Museum Bulletin* 243: 1-653.

Froeschner RC. 1996. Lace Bug Genera of the World, I: Introduction, Subfamily Cantacaderinae (Heteroptera: Tingidae). *Smithsonian Contributions to Zoology* 574: 1–43.

Goloboff PA. 1998. Nona, version 2.0. Fundacion e instituto Miguel Lillo, Miguel Lillo 205, 4000 S.M. De Tucuman, Argentina.

Goloboff PA, Farris JS, Nixon KC. 2008. TNT, a free program for phylogenetic analysis.

Cladistics 24: 774-786.

Golub VB. 2001. *Archepopovia yurii* n. gen. n. sp. a new remarkable lace bug from Baltic amber, with some notes on phylogeny and classification of Tingidae (Heteroptera, Tingidae). *Mitteilungen aus dem Geologisch-Palaontologischen Institut der Universitat Hamburg* 85: 263-276.

Golub VB, Popov YA. 2003. The new fossil genus of Vianaididae (Heteroptera: Tingoidea) from the Cretaceous amber of New Jersey; evolution of the family in the Late Cretaceous. *Acta Zoologica Cracoviensia 46(suppl. - Fossil Insects)*: 109-116.

Guidoti M, Barcellos A. 2013. On the nymphs of lantana lace bug *Teleonemia scrupulosa* Stål (Hemiptera: Heteroptera: Tingidae: Tinginae): ontogenetic features of integumentary structures highlighted. *Zootaxa* 3613(3): 289-296.

Guidoti M, Tallamy D, Marsaro Junior AL. Maternal care in *Gargaphia decoris* (Heteroptera, Tingidae), with comments on this behavior within the genus and family. (in prep).

Guilbert É. 2000. Revision of the genus *Parada* Horváth (Hemiptera: Tingidae) with cladistic analysis. *Proceedings of the Entomological Society of Washington* 102: 816-830.

Guilbert É. 2001. Phylogeny and evolution of exaggerated traits among the Tingidae (Heteroptera, Cimicomorpha). *Zoologica Scripta* 30(4): 313-324.

Guilbert É. 2004. Do larvae evolve the same way as adults in Tingidae (Insecta: Heteroptera)? *Cladistics* 20: 139-150.

Guilbert É. 2012. Phylogeny of Cantacaderinae (Heteroptera: Tingidae) revisited after the description of a new genus and new species from New Caledonia. *European Journal of Entomology* 109: 111-116.

Kormilev NA. 1955a. A new myrmecophil family of Hemiptera from the delta of Rio Parana, Argentina. *Revista Ecuatoriana de Entomologia y Parasitologia* 2(3-4): 465-477.

Kormilev NA. 1955b. Notas Sobre "Tingidae" Neotropicales (Hemiptera). *Revista Brasileira de Biologia* 15(1): 63-68.

Lethierry L, Severin G. 1896. *Catalogue Général des Hémiptères - Tome III*. 275 p.

Lis B. 1999. Phylogeny and Classification of Cantacaderini [= Cantacaderidae stat. nov.] (Hemiptera: Tingoidea). *Annales Zoologici* 49(3): 157-196.

Livingstone D. 1978. On the body outgrowths and the phenomenon of "sweating" in the nymphal instars of Tingidae (Hemiptera: Heteroptera). *Journal of Natural History* 12: 377-394.

Mason JR, Neal J, Oliver JE, Lusby WR. 1991. Bird-Repellent Properties of Secretions from Nymphs of the Azalea Lace Bug. *Ecological Applications* 1(2): 226-230.

Monte O. 1938. Tingitídeos Neotrópicos. *Boletím Biológico (Nova Serie)* 3(3-4): 127-132.

Monte O. 1939a. *Sphaerocysta brasiliensis* Monte (Hemiptera-Tingitidae*). Boletím Biológico (Nova Serie)* 4(3): 516-518.

Monte O. 1939b. Lista preliminar dos tingitideos de Minas Gerais. *Revista da Sociedade Brasileira de Agronomia* 2(1): 63-87.

Monte O. 1940. Catalogo dos Tingitídeos do Brasil. *Arquivos de Zoologia* 2(3): 65-174.

Monte O. 1941. Quatro Novos Tingitídeos da América do Sul. *Revista Brasileira de Biologia* 1(4): 373-378.

Monte O. 1942. Apontamentos Sôbre Tingitideos (Hemiptera) Americanos, Especialmente do Brasil. *Arquivos do Instituto Biológico de São Paulo* 13: 91-98.

Montemayor SI, Carpintero DL. 2007. A new macropterous genus with a new species of Vianaididae (Heteroptera, Tingoidea, Vianaididae) from Peru. *Studies on Neotropical Fauna and Environment* 42(2): 133-136.

Montemayor SI, Costa LAA. 2009. Systematic revision of *Macrotingis* and phylogenetic analysis of the genera *Macrotingis* and *Ceratotingis* (Heteroptera: Tingidae). *European Journal of Entomology* 106: 631-642.

Neal J, Schaefer C. 2000. Lace Bugs (Tingidae). In: Schaefer CW, Panizzi AR. *Heteroptera of Economic Importance*. CRC Press, 85-137.

Nixon KC. 2002. Winclada (BETA) ver. 1.00.08. Retrieved from http://www.cladistics.com/

Parr A, Tallamy DW, Monaco EL, Pesek JD 2002. Proximate Factors Regulating Maternal Options in the Eggplant Lace Bug, *Gargaphia solani* (Heteroptera: Tingidae). *Journal of Insect Behavior* 15: 495-511.

Péricart J. 1981. Revision Systématique des Tingidae Ouest-Paléarctiques VIII. Contribution a L'Étude du Genre *Tingis* Fabricius (Hemiptera). *Annales de La Societé Entomologique de France* 17: 483-519.

Schaefer CW. 2003. Prosorrhyncha (Heteroptera and Coleorrhyncha). In: Vicent HR, Cardé RT. eds. *Encyclopedia of Insects*. Amsterdam: Academic Press, 947-965.

Schuh RT, Cassis G, Guilbert É. 2006. Description of the First Recent Macropterous Species of Vianaidinae (Heteroptera: Tingidae) with Comments on the Phylogenetic Relationships of the Family within the Cimicomorpha. *Journal of the New York Entomological Society* 114(1-2): 38-53.

Sereno PC. 2007. Logical basis for morphological characters in phylogenetics. *Cladistics* 23: 565-587.

Silva P. 1956. Tingideos da Bahia (Insecta - Hemiptera). *Boletim do Instituto Biológico da Bahia* 3(1): 10-77.

Stål C. 1858. Bidrag Till Rio Janeiro-Traktens Hemipter-Fauna. *Kongl. Svenska Vet. Akad. Handl.* 2(7): 1-75.

Stål C. 1873. Enumeratio Hemipterorum. 3. *Kongl. Svenska Vet. Akad. Handl.* 11(2): 1-163.

Van Duzee EP. 1889. Hemiptera from Muskoka Lake district. *Canadian Entomologist* 21(1): 1-11.

Walker F. 1873. *Catalogue of Hemiptera Heteroptera in the British Museum*. Part VI.

Capítulo 1

Sphaerocysta costai n. sp. (Heteroptera: Tingidae): new light on the evolutionary trends of Tingidae morphology

Marcus GUIDOTI[1] and Sara MONTEMAYOR[2]

Abstract

A new species of *Sphaerocysta* Stål, 1873, a Neotropical Tingidae (Hemiptera, Heteroptera) genus, is described. *Sphaerocysta costai* n. sp. was collected in the Argentinean Yungas in the provinces of Jujuy (Calilegua) and Salta (Urundel). The most important diagnostic characters were illustrated for adults and fifth instar nymph. This new species provides key evidence for the understanding of evolutionary trends among the family on the basis of nymphal and adult morphology which is discussed and considered in the context of a phylogenetic analysis. An identification key to the species of *Sphaerocysta* is provided, as well as comments on the systematic status of the genus.

Keywords. Evolutionary trends, Neotropical, *Sphaerocysta*, Taxonomy, Tingidae.

Introduction

The bizarre Tingidae morphology of adults and nymphs have been the subject of interest in the search of evolutionary trend**s** (Guilbert, 2001, 2004). It has been hypothetized that adults and nymphs tend to evolve from simpler to more complex morphologies (Guilbert, 2001, 2004). According to this approach, plesiomorphic species have adults that do not exhibit paranota, hood, pronotal carinae and wide hemelytra, and nymphs without outgrowths. Moreover, nymphal outgrowths as well as adult exaggerated traits have been assumed to be adaptative rather than hypertelic (Guilbert, 2001, 2004, 2005).

Sphaerocysta Stål, 1873 is a Neotropical genus composed by 12 species, extending from Panama to Argentina. All species are registered in Brazil, with the exception of *S. nosella* Drake & Hambleton 1945, which is known from Ecuador. Two species were also collected in other countries besides Brazil: *S. globifera* (Stål, 1858), registered in Argentina and Paraguay; and *S. inflata* (Stål, 1858), found in Argentina, Bolivia and Paraguay. Both of these species were transfered to *Sphaerocysta* in the time of its description by Stål, *S. globifera* being the type-species. This genus can be characterized by the spherical hood, the absence of occipital spines and by the presence of two cysts, one in the posterior pronotal projection and the other in the posterior region of the discoidal area of hemelytra.

The most recent contribution on the genus systematics was the description of the fifth instar of two species (*S. inflata* and *S. angulata* Monte, 1941 (Guilbert &

Montemayor, 2010). Before this contribution, the last work that reported the genus was almost 55 years ago (Drake & Davis, 1960). Host plant were recorded for only three species, all at family level (Bignoniaceae, Drake & Ruhoff, 1965). Biological, ethological and reproductive data are also unknown for the *Sphaerocysta* species, as they are for most of tingids. Neither a taxonomic revision nor an identification key are available.

In the present manuscript we describe a new *Sphaerocysta* species on the basis of adult specimens and fifth instar exuviae. We have found this new species particularly interesting as its morphology provides new evidence for the understanding of evolutionary trends among Tingidae. With the purpose of bringing ligth to this discussion, we revisited Guilbert's phylogenetic analysis (2004) including the new taxon as well as the other congeneric species that had their nymphs described (*S. angulata* and *S. inflata* – Guilbert & Montemayor, 2010). We also provide an identification key for the genus and comments on its systematics.

Material and Methods

The specimens were collected in 2007, in the Argentinean provinces of Jujuy (Calilegua at 800m a.s.l.) and Salta (Urundel at 575m a.s.l.). Photographs were captured with a digital camera attached to a stereomicroscope. Measurements were obtained using an ocular micrometer and are represented in milimeters, the mean given outside the parentheses. Drawings were made with the aid of photographs, and vectorial image files were produced. The terminology follows Drake & Davis (1960). The identification key was developed after the study of type-material and original descriptions. The material studied for the description of the new species were deposited in the Museo de La Plata (MLPA – La Plata, Buenos Aires, Argentina) and in the Muséum National d'Histoire Naturelle (MNHN – Paris, Île-de-France, France), but only the specimen of MLPA were measured.

The phylogenetic analysis was based on Guilbert's matrix (2004) that comprised 61 characters (34 larval characters and 27 adult characters) and 33 taxa. The new species here described as well as *S. angulata* and *S. inflata* were included, thus the matrix used herein comprises 61 characters and 36 taxa (Table 1). All tree searches were performed in Nona (version 2.0, Goloboff, 1998) under the same parameters used in Guilbert's analysis (Guilbert, 2004 – heuristic analysis, 1000 replications and two starting trees per replication, multiple TBR+TBR as search strategy). As in Guilbert (2004) all characters were considered as non-additive and equally weighted to avoid any a priori assumptions.

Absolute Bremer support values (Bremer, 1994) were calculated in TNT (Goloboff et al., 2008) retaining suboptimal trees up to 10 extra steps. We used the same parameters, search strategy and software to avoid any other variable besides the new taxa. In order to test the effect on the topology of different data sets and to provide evidence on the systematics status of *Sphaerocysta*, we also analyzed the data partitioned into nymphal (1-34) and adult characters (35-61).

Results

Sphaerocysta costai sp. n.

Diagnose. Remarkably blackish; hood spherical, uniformly punctuated; humeri of paranota triangular and strongly projected, lateral carina with two rows of areolas at the highest part, posterior pronotal cyst conspicuously low; costal area of hemelytra uniseriated. Fifth instar nymph with pronotum flat, small median tubercles in abdominal segments II-VI, without lateral abdominal tubercles.

Description. General color blackish (Fig. 1), yellowish in some parts of the hemelytra or completely yellowish (specimens recently emerged). Antennae longer than half of the body length; scape and pedicel subequal in size; basiflagellomere four times the length of distiflagellomere, the last at least two times longer than the scape or pedicel;

distiflagellomere black, yellow at its base, the others entirely yellowish. Head with two spines (frontal pair); bucculae closed in front, with two rows of areolas, outer margin convex; postero-orbital plate present. Rostrum long, reaching the anterior region of metasternum; apex black. Pronotum black, except paranota, lateral carina and the apex of the posterior pronotal cyst, these yellowish. Hood black, spherical; punctures uniform, similar in size to those of the pronotal disc. Median carinae low, almost absent on the pronotal disc, ending in a small and yellowish cyst on the posterior projection of pronotum, two times lower than the hood. Lateral carina high, strongly sinuate, with two full-developed rows of areolas at the highest part, these large and complete (Fig. 2). Paranota areolated, slightly expanded; perpendicular to the pronotal disc anteriorly, subvertical, strongly projected and triangle-shapped in the humeri (Fig. 3a). Rostral channel as illustrated (Fig. 3b). Legs light yellowish, with few and short hairs. Hemelytra narrow, light yellowish, with two large black stains: one at the hemelytra cyst, excluding the very top of the cyst and the other a posteriorly declivent conical-shapped stain in the sutural area; outer margin conspicuously widening anteriorly, then sligthly narrowing through the rest of the hemelytra extension (Fig. 4); widest part at sutural area; costal area uniseriated, with sub-rectangular cells anteriorly, half the size of the posterior ones, these rectangular; subcostal area with three to five rows of areolas in the widest part, which is located at the position of the higher region of the hemelytra cyst; discoidal area firstly biseriated, with five rows of areolas in the widest part, located at the same position than the widest part of the subcostal area; radius-media sinous;

sutural area with small cells anteriorly, similar in size with those of the distal part of the discoidal area; larger and pentagonal cells posteriorly, same size than the bigger ones of costal area; outer row bears large, squared cells, with the inner edge slightly rounded. Abdomen narrow and brownish, with few and short hairs, widest part between the fourth and fifth segment.

Measurements (2 ♂–1 ♀): scape length, 0.18 (0.15–0.20–0.19); pedicel length, 0.11 (0.12–0.10–0.10); basiflagellomere length, 1.22 (1.20–1.27–1.18); distiflagellomere length, 0.35 (0.37–0.37–0.32); discoidal area length, 0.92 (0.88–0.92–0.95); total body length without wings, 2.13 (2.13–2.20–2.07); total body length, 2.70 (2.70–2.67–2.73); total body width, 0.92 (0.92–0.92–0.93).

Fifth instar exuvie. Body glabrous (Fig. 5a). Whitish to yellowish; pronotum medially, anterior and posterior extreme parts of wing pads and abdomen dorso-medially black. Occipital tubercles on head present and simple, the rest of the head broken. Pronotum flat; laterally with a few scattered long hairs and a simple posterior tubercle; without median tubercles. Wing pads slightly wider than pronotum, lateral margins with a few scattered long hairs. Mesonotum and metanotum without tubercles. Abdomen (Figs. 6a–6b) without lateral tubercles, lateral margins with very long scattered hairs; tergites with central part slightly swollen, II–VI bearing a posterior median tubercle, these became smaller posteriorly.

Measurements: scape length, 0.14 (0.14–?–?–0.13); pedicel length, 0.09 (0.10–?–?–

0.08); pronotal length, 0.61 (0.62–0.56–0.62–0.65); pronotal width, 0.86 (1.10–1.10–1.13–1.08); wing pad length, 1.05 (1.09–1.08–1.07–0.95); wing pad width, 0.45 (0.44–0.43–0.45–0.46); abdominal length, 1.38 (1.36–1.53–1.40–1.23).

Material. HOLOTYPE: 1 male, Calillegua, Jujuy, Argentina, 23º 44 46' S 64º 51 186' W, 800m, 04-VI-2007, Montemayor col. (MLPA). PARATYPES: 1 male, same data (MLPA); 1 female, same data, É. Guilbert réc. (MNHN); 1 female, Urundel, Salta, Argentina, 23°26 638’S 64°30 428’W, 575m, 07-VI-2007, Guilbert & Montemayor col (MLPA). IMMATURES: 1 exuvie, Urundel, Salta, Argentina, 23°26 638’S 64°30 428’W, 575m, 07-VI-2007, Guilbert & Montemayor col (MLPA); 3 exuvies, Calillegua, Jujuy, Argentina, 23º 44 46' S 64º 51 186' W, 800m, 04-VI-2007, Montemayor col. (MLPA). The exuvia from Salta most likely belongs to the female collected in this province, as they were found together and the female presents a lighter colour pattern, suggesting that it was recently emerged.

Etymology. The species was named after Luiz Costa (MNRJ – Museu Nacional, Rio de Janeiro, Brazil), a friend and talented illustrator who dedicated his professional carreer to provide very important contributions mostly to the taxonomy of Miridae and Tingidae. His cooperative attitude in the MNRJ collection allows researchers from different taxonomic groups to develop their studies, and we believe that it is a very positive way of collaborating which should be acknowledged.

Distribution*:* Argentina*:* Jujuy (Calilegua) and Salta (Urundel).

Comments. The new species resembles *S. angulata* in the general dorsal habitus, mostly because of the triangular humeri on the paranota (Fig. 3) and the shape of the hemelytra. Besides the similarity in adult morphology and the sympatry of these species (Fig. 7), there are strong differences between both, especially considering the fifth instar nymphs. These species can be separated by the hood, more ovalate in *S. angulata*; by the lateral carina height, *S. costai* n. sp. with two rows of areolas at the highest part (Fig. 2, 3a, 3c) and by the paranota, broader in *S. costai* n. sp., with the humeri more projected than in *S. angulata* (Fig. 3a, 3c). In addition, the former exhibits several lateral tubercles as well as a pronotum with a tumid elevation and a keel that are absent in *S. costai* n. sp., which presents dorsally small median tubercles in the posterior part of abdominal segments that the former lacks (III and IV segments – Fig. 6).

From the comparison of females with males we observed that the subcostal area is narrower in males (three rows of areolas at the widest part – Fig. 4a) than in females (five rows – Fig. 4b). Unfortunately, this sexual dimorphism was observed through the study of very few specimens (two males and two females). *Sphaerocysta angulata* also presented this same dimorphism from the study of two paratypes. This sexual difference in the hemelytra has been described in Tingidae for species of other genera, such as *Pleseobyrsa* Drake & Poor (Froeschner, 1991; Montemayor et al., 2011), where females also present wider subcostal area.

Key to species of *Sphaerocysta*

1. Cells of the outer row of paranota bigger than the ones of the inner row, or paranota with only one row of cells 2
1'. Paranota with at least two rows of cells, these subequal in size. 3

2. Size of areolas unequal in the dorsal part of the hood. ....*S. nosella*
2'. Size of areolas subequal in the dorsal part of the hood............................... 3

3. Lateral carina absent...*S. fumosa* Drake, 1928
3'. Lateral carina present.. 4

4. Hemelytra with 11-12 lines of cells in the costal area before the rounded posterior region; abdomen reaching the middle of the hemelytra..........*S. biseriata* Drake, 1928
4. Hemelytra with 6-9 lines of cells in the costal area before the rounded posterior region; abdomen conspicuously surpassing the middle of the hemelytra.........*S. inflata*

5. Cyst on the posterior pronotal projection absent ....*S. egregia* Drake, 1928
5'. Cyst on the posterior pronotal projection present 6

6. Cyst on the posterior pronotal projection almost as high as the hood, slightly higher or lower 7
6'. Cyst on the posterior pronotal projection conspicuously lower than the hood *8*

7. Hood triangular anteriorly; paranota entirely biseriated, with areolas of similar size; cyst on the posterior pronotal projection higher than the hood....... *S. stali* Drake, 1928
7'. Hood rounded anteriorly; paranota irregularly biseriated, with areolas slightly different in size; cyst on the posterior pronotal projection lower than the hood .... *S. globifera*

8. Humeri projected, triangular 9
8'. Humeri not projected, rounded... 10

9. Humeri triangular; areolas of lateral carina not fully-developed ....*S. angulata*
9'. Humeri strongly triangular; areolas of lateral carina fully-developed, two rows at the highest part ....*S. costai* n. sp.

10. Paranota areolated, constricted in the middle line ....*S. paris* Drake, 1939
10'. Paranota areolated, without any constriction 11

11. Costal area of hemelytra regularly biseriated anteriorly *S. brasiliensis* Monte, 1938
11'. Costal area of hemelytra irregularly bisseriated anteriorly, or uniseriated 12

12. Costal area of hemelytra irregularly biseriated at the anterior region ..... *S. propria* Drake & Poor, 1939
12'. Costal area of hemelytra uniseriated anteriorly ....*S. maculata* Monte, 19*42*

Phylogenetic analysis

The phylogenetic analysis resulted in 32 most parsimonious trees (MPTs) with 287 steps. The strict consensus is presented (Fig. 8, length (L) = 317, consistency index (CI) = 0.38, retention index (RI) = 0.58). The topology presents differences if compared to the one obtained by Guilbert (2004). The major topological differences were observed at clades nine and 17 of Guilbert's analysis. In the last, *Perissonemia rectisulca* Guilbert, 2002 was not recovered as sister-group of *Catoplatus carthusianus* (Goeze, 1778) as the Guilbert analysis indicates. In addition, clade nine was recovered here almost fully unresolved, though some of its relationships were conserved: *Corythauma ayyari* (Drake, 1933) + *Tingis buddleiae* Drake, 1930; *Amblystira peltogyne* Drake & Hambleton, 1935 + *Kapiriella maynei* (Schouteden, 1919); *Compseuta ornatella* (Stål, 1855) + *Cephalidiosus longispini* Guilbert, 2002 + *Tingis irregularis* (Montrouzier, 1861); and *Leptopharsa gibbicarina* Froeschner, 1977 + *Corythucha mcelfreshi* Drake, 1921 + *Stephanitis typica* (Distant, 1903). The partitioned data analyses with the adult characters retrieved 545 MPTs of 114 steps, whereas the nymphal data set analysis recovered 81 MPTs of 137 steps. The strict consensus are provided (respectively: Fig. 9a, L = 166, CI = 0.26, RI = 0.34; Fig. 9b, L = 155, CI = 0.42, RI = 0.62). The only clade found in all three consensus and in Guilbert's analysis was *A. peltogyne* + *K. maynei*.

In the full data analysis, *Sphaerocysta* was recovered as a paraphyletic group, with no resolutions of the relationships of its species. The analysis of the adult data set also retrieved *Sphaerocysta* as a paraphyletic genus, but *S. costai n. sp.* and *S. angulata* were recovered as a monophyletic clade. The nymphal data set analysis found *S. inflata* as the sister-group of *S. angulata,* whereas *S. costai n. sp.* was more closely related with a basal polytomy composed by species known by their simple nymphal morphology. In the full data set and in the adult data set analyses, the sister-group of *Sphaerocysta* was the *L. gibbiricarina* clade. All the analyses showed considerably low tree fit statistics.

Discussion

Sphaerocysta has a puzzled taxonomic status. There are two very distinct morphological groups in the genus: the *S. inflata* group (which besides *S. inflata* includes: *S. biseriata*, *S. fumosa* and *S. nosella*) and the *S. globifera* group (including *S. globifera*, *S. angulata*, S. *brasiliensis*, *S. costai* n. sp., *S. egregia*, *S. maculata*, *S. paris*, *S. propria* and *S. stali*). Each group can be recognized by the outer row of cells in paranota (cells bigger than those of the inner row in the *S. inflata* group) and the shape of hemelytra (a strongly pronunciated angle at the anterior region in the *S. inflata* group). *Sphaerocysta costai* n sp. and *S. angulata* belong to the *S. globifera* group, since they do not present these traits. Interestingly, the immature of *Sphaerocysta* described so far (*S. angulata*, *S. inflata* and *S. costai* n. sp.) are remarkably different. In fact, the presence of median tubercles in the segments III and IV in *S. costai* n. sp. is a very unusual feature within the family. The absence of the median tubercle on the VIII segment is also very interesting, as it is present in the nymphs of *S. angulata* and *S. inflata*. In addition, species whose nymphs do not bear any lateral tubercle generally are not congeneric with species whose nymphs do present them. To our knowledge, this is the first genus so far described with such intrageneric variation in nymphal morphology, although it is important to emphasize that very few Tingidae nymphs are known.

The different data sets (nymphal and adults characters exclusive data sets) as well as the full data analysis showed different results. If characters only from adult morphology were considered, the consensus tree showed less resolution than the nymphal or the full data set analyses. The analyses showed considerably low tree fit statistics and generaly poorly resolved consensus trees, although these results must be carefully interpreted due the high homoplasy levels presented in these analyses. Besides, we have evidence from the adult morphology that *S. angulata* is the sister-group of *S. costai* n. sp. in a monophyletic clade, whereas *S. inflata* is not closely related with these species. This is consistent with the adult morphological groups discussed above. Moreover, the outstanding nymphal morphology of *S. costai* n. sp. could be the reason for such unclear relationships among the species of *Sphaerocysta* in both nymphal and full data set analyses. With the knowledge of the other ontogenetic steps of the nymphal development of these species, and with the inclusion of such data in this kind of analyses, incongruences might be solved and new patterns might be found for nymphal morphology. As only the fifth instar of *S. costai* n. sp. is known, we can not assume that the lateral tubercles observed in its congeners are also absent in the others instars of this species or if they were lost in some ontogenetic stage during nymphal development. It is also not known if these tubercles are present in all five instars or if they appear in some specific ontogenetic step of the *S. angulata* and *S. inflata* nymphal development. The lack of information on these ontogenetic stages is not exclusive of *Sphaerocysta*, but for the majority of the Tingidae species. As the nymphal data available are still poor, we believe that the result of the adult data set analysis brings the most interesting results for the genus systematics.

To understand the evolutionary trends in adult and nymphal morphology, Guilbert (2004) included more than one species for only one genus (*Tingis* – *T. buddleiae* and *T. irregularis*). Although it is not expected that there should be remarkable intrageneric variations in nymphal morphology, *Sphaerocysta costai* n. sp., here described, brings new key evidence on this matter. Another example of this kind of intrageneric variation can be found in *Psilobyrsa*. In this Neotropical genus the adults of its two known species are very similar, whereas nymphs of *P. vriesiae* have small and simple tubercles instead of the big and complex ones observed in *P. aechemeae* nymphs (Guidoti & Barcellos, in prep). Such intrageneric variations could allow a reinterpretation of the patterns of heterochronic events in Tingidae (Guilbert et al., 2008). Because these type of data can aid phylogenetic analyses, as well as the search for evolutionary trends within the family, its descriptions should not be neglected (Guilbert et al., 2008; Guidoti & Barcellos, 2013). The evolutionary scenario proposed up to now indicates a tendency to evolve convergently from simple to complex shapes in both adults and nymphs (Lee, 1969; Guilbert, 2001, 2004). With the addition of the species of *Sphaerocysta* in Guilbert's matrix (2004), this evolutionary trend was not clearly recovered. Species with simple nymphal and adult morphologies (e. g., *Dictyla rasilis* (Drake & Maa, 1955) were placed in a polytomy with species which present complex nymphal morphology (e. g., *C. ayyari* clade). This indicates that the evolution of such traits in Tingidae could be more intricate than previously thought.

The evolution of exaggerated traits were argued to be adaptative rather than merely hyperthelic (Guibert, 2001, 2004). Those conclusions were based on the assumption that nymphal outgrowths and adult wide-hemelytra are associated with protective activities (Guilbert, 2004). There is evidence that nymphal outgrowths are associated with physical and chemical defense activities (Aldrich et al., 1991; Mason et al., 1991; Scholze, 1992) whereas adult wide-hemelytra are considered to be related with maternal care behavior (Guilbert, 2004). However, Tallamy & Iglay reported the first case of maternal behavior for a short-hemelytra tingid (2004 – *Compseuta picta*). Tallamy & Denno (1981) also revisited the natural history of four tingids and concluded that not only maternal care or nymphal alarm pheromones and physical protection are available, but reproductive and oviposition strategies may also play an important role in the attempt to minimize predatism. Thus, the premisses of those conclusions have now new evidence and they should be reconsidered in new efforts towards the understanding of these evolutionary trends within the family.

Considering the taxonomic scenario described here, the need for a comprehensive revisionary and phylogenetic work within this genus is undeniable. Furthermore, the new evidence presented and discussed above calls for new analyses that consider a large sampling approach, a more comprehensive list of characters and different search strategies (e.g., implied weighting).

Acknowledgments

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References

Aldrich J.R., Neal J.W., Oliver J.E. & Lusby W.R. 1991: Chemistry via-à-vis Maternalism in Lace Bugs (Heteroptera: Tingidae): Alarm Pheromones and Exudate Defense in *Corythucha* and *Gargaphia* Species. — *J. Chem. Ecol.* **17**: 2307–2323. —

Bremer, K. 1994: Branch Support and Tree Stability. — *Cladistics*. **10**: 295–304.

Drake C.J. 1928: New and Little Known Neotropical Tingitidae. — *Iowa State Coll. J. Sci.* **3**: 41–56.

Drake, C.J. 1939: Seven New South American Tingitidae (Hemiptera) — *Rev. de Entom.* **10**: 525–530.

Drake C.J. & Davis N.T. 1960: The Morphology, Phylogeny, and Higher Classification of the Family Tingidae, Including the Description of a New Genus and Species of the Subfamily Vianaidinae (Hemiptera: Heteroptera). — *Entomol. Am.* **39**: 1–100.

Drake C.J. & Hambleton E.J. 1945: Concerning Neotropical Tingitidae (Hemiptera). — *J. Washingt. Acad. Sci.* **35**: 356–367.

Drake C.J. & Poor M.E. 1939: Seven New American Tingitidae (Hemiptera). — *Bull. Brooklyn Entomol. Soc.* **34**: 31–35.

Drake C.J. & Ruhoff F. A. 1965: Lacebugs of the World: A Catalog (Hemiptera: Tingidae). — *United States Natl. Museum Bull.* **243**: 1–634.

Froeschner R.C. 1991: The lace bug genera *Pleseobyrsa* and *Stragulotingis*: reviews, keys, and description of one new species in each (Heteroptera□ : tingidae□ : tinginae). **—** *Proc. Entomol. Soc. Washingt.* **93**: 767–771.

Goloboff, P.A. 1998: Nona, version 2.0. Fundacion e instituto Miguel Lillo, Miguel Lillo 205, 4000 S.M. De Tucuman, Argentina.

Goloboff P.A., Farris J.S. & Nixon K.C. 2008: TNT, a free program for phylogenetic analysis. **—** *Cladistics.* **24**:774–86.

Guidoti M. & Barcellos A. 2013: On the nymphs of lantana lace bug *Teleonemia scrupulosa* Stål (Hemiptera: Heteroptera: Tingidae: Tinginae): ontogenetic features of integumentary structures highlighted. **—** *Zootaxa*. **3613**: 289–296.

Guilbert É. 2001: Phylogeny and evolution of exaggerated traits among the Tingidae (Heteroptera, Cimicomorpha). **—** *Zool. Scr.* **30**: 313–324.

Guilbert É. 2004: Do larvae evolve the same way as adults in Tingidae (Insecta: Heteroptera)? **—** *Cladistics*. **20**: 139–150.

Guilbert É. 2005: Morphology and evolution of larval outgrowths of Tingidae (Insecta, Heteroptera), with description of new larvae. **—** *Zoosystema*. **27**: 95–113.

Guilbert É. & Montemayor S.I. 2010: Tingidae (Insecta, Heteroptera) from the Argentinan Yungas: new records and descriptions of selected fifth instars. **—** *Zoosystema*. **32**: 549–565.

Guilbert É., Desutter-Grandcolas L. & Grandcolas P. 2008: Heterochrony in Tingidae (Insecta: Heteroptera): paedomorphosis and/or peramorphosis? **—** *Biol. J. Linn. Soc*. **93**: 71–80.

Lee C.E. 1969: Morphological and phylogenic studies on the larvae and male genitalia of the East Asiatic Tingidae (Heteroptera). **—** *J. Fac. Agric*. **15**: 138–256.

Mason J.R., Neal J., Oliver J.E. & Lusby W.R. 1991: Bird-Repellent Properties of Secretions from Nymphs of the Azalea Lace Bug. **—** *Ecol. Appl.* **1**: 226–30.

Monte O. 1938: Novas tingitideos. **—** *O Campo*. **Feb**: 64.

Monte O. 1941: Quatro Novos Tingitídeos da América do Sul. **—** *Rev. Bras. Biol*. **1**: 373–8.

Monte O. 1942: Apontamentos Sôbre Tingitideos (Hemiptera) Americanos, Especialmente do Brasil. **—** *Arq. do Inst. Biológico São Paulo*. **13**: 91–98.

Montemayor S.I., Gónzalez-Herrera A. & Villalobos K. 2011: Description of a new species of *Pleseobyrsa* (Heteroptera: Tingidae) from Costa Rica. **—** *Rev. Mex. Biodivers*. **82**: 475–80.

Scholze, W. 1992. "Secretion sweating" in lace bugs larvae: morphology, chemistry and biological significance of integument formation with secretory function in larvae lace bugs (Heteroptera, Tingidae). Ph.D. dissertation. Universität Bayreuth, Bayreuth. (In German).

Stål C. 1858: Bidrag Till Rio Janeiro-Traktens Hemipter-Fauna. **—** *Kongl. Sven. Vet. Akad. Handl*. **2**: 1–75.

Stål C. 1873: Enumeratio Hemipterorum. 3. **—** *Kongl. Sven. Vet. Akad. Handl*. **11**: 1–163.

Tallamy D.W. & Denno R.F. 1981: Alternative Life History Patterns in Risky

Enrironments: An Example from Lacebugs. In Denno R.F. & Dingle H. (eds.): *Insect Life Histoty Patterns: Habitat and Geographic Variation*. Springer-Verlag, pp. 129–147.

Tallamy D.W. & Iglay R.B. 2004: Maternal Care in Compseuta picta, an African Lace Bug (Heteroptera: Tingidae). — *J. Insect Behav*. ***17****: 247–249.*

Table 1. Character matrix with 61 morphologicla characters and 36 taxa. Symbols: -, missing data; [], multiple states.

	1 2 3 4 5 6 0123456789012345678901234567890123456789012345678901234567890
Chrysochnoodes holognai	0-0-0-020-0-0-0-0-00-0000000-1010-20000010-0-00---0000-0-0001
Annomatocoris coleopteratus	0-0-0-010-0-0-0-0-00-0000000-0100-10000020-0-00---0000-0-0001
Cantacader lethierryi	10100-0010200-0-0-021101011041101[13]2031012101111100001100001000
Phatnoma marmorata	10100-1010101010100200011111011013103101210110110000110000100
Eocader vergrandis	0-100-100-0-0-0-0-00-0000000-110131031002100-0110000110000100
Thaicader martensi	0-1010100-0-0-0-0-00-0000000-1100-1031001100-0110000110000100
Nobarnus nigriceps	100-0-020-0-0-0-0-00-0000000-1100-0012010101001001111310000000
Amblystira_peltogyne	101010020-0-0-0-2401-000110141100-1021000101000---11121000000
Orotingis eueides	0-0-0-020-0-0-0-0-00-0000000-1100-0011001100-00---11132000000
Leptopharsa gibbicarina	100-1002100-0-2020021001110101100-1031202121201112111132010000
Catoplatus carthusianus	10100-020-0-0-0-0-00-0000000-1100-1131010101101120111120000000
Corythauma ayyari	1212120212202220200230211101211011103131110110111111121010000
Dictyla rasilis	111011021111210-21022001100111100-1031010101101220111211000000
Compseuta ornatella	100-0-0210100-0-0-0200000000-11112103101010100102011121010000
Monosteira unicostata	101010020-0-0-0-200200011001011012103101010О-0102011121010100
Kapiriella maynei	100-1002100-232224020011110141110-1021000101000---11121000000
Urentius vepris	101010021020200-2002000110012110121031011111101220111210001110
Corythucha mcelfreshi	131013021310200-23024002220131101110312111213012111113212001 0
Stephanitis typica	10101002100-0-2020021001110101100-1031211121301212111132120000
Agaotingis pindai	101010021020222000-023001110001101300311121000-0121011131000000
Cephalidiosus longispini	1212120212120-0-0-023001110021100-103201210100102011132000000
Tingis irregularis	1212120210200-0-0-0200000000-110121031011101001020111200000000
Physatocheila dissimilis	101010020-0-0-0-0-01-0000000-110101031011101101121111200000000
Idiocysta dryadis	101010020-0-0-0-0-0200001000011013102101111110121111121000000
Teleonemia scupulosa	10101002100-0-2020120001110141101[02]113101111201021111200000001
Epimixia nigriceps	100-0-020-0-0-0-0-00-0000000-1100-1021010101100-001110-000000
Perissonemia rectisulca	100-0-020-0-230-0-00-0000000-1100-103101110110100011120000000
Cysteochila madagascariensis	101010021020202020120022110101101[13]103101110110122111120000001
Acalypta muscii	10100-020-0-0-0-0-00-0000000-1100-103101[12]100-0110111111000000
Tingis buddleiae	1212120212122222221230212202211013103101010120110111121000011
Atheas insignis	0-0-0-020-0-0-0-0-01-0000000-1100-1021010101101101111111000000
Aristobyrsa uaupesensis	101010020-0-0-0-0-00-0200000-1111100220011112011011113110001 1
Dictyonota strichnocera	10100-010-0-0-0-0-00-0011111011013113100111120110111121010000
Sphaerocysta costai	10----03--0-0-0-0-00-001100001100-1031211101201010111111100000
Sphaerocysta angulata	1010100310102020200210211101011110-103121110120101011111100000
Sphaerocysta inflata	1010100310102020201210211101011100-103121112120120[01]11111110000

Fig. 1. Dorsal habitus of *Sphaerocysta costai* n. sp. Scale bar: 0.5 mm.

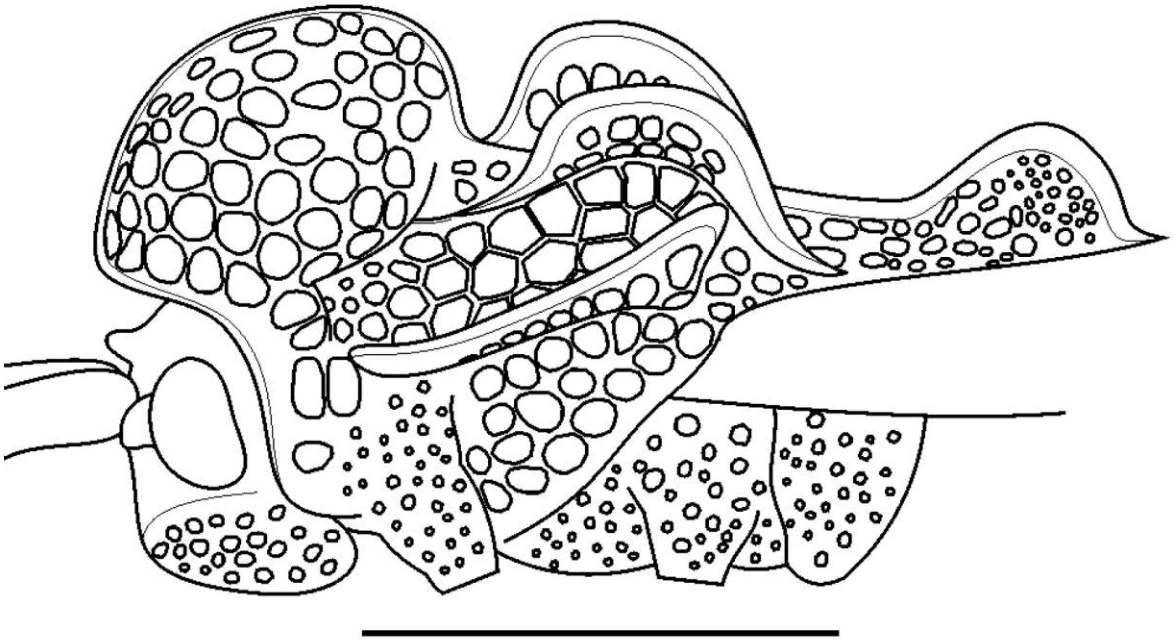

Fig. 2. Lateral view of the head and pronotum of *Sphaerocysta costai* n. sp. Scale bar: 0.5 mm.

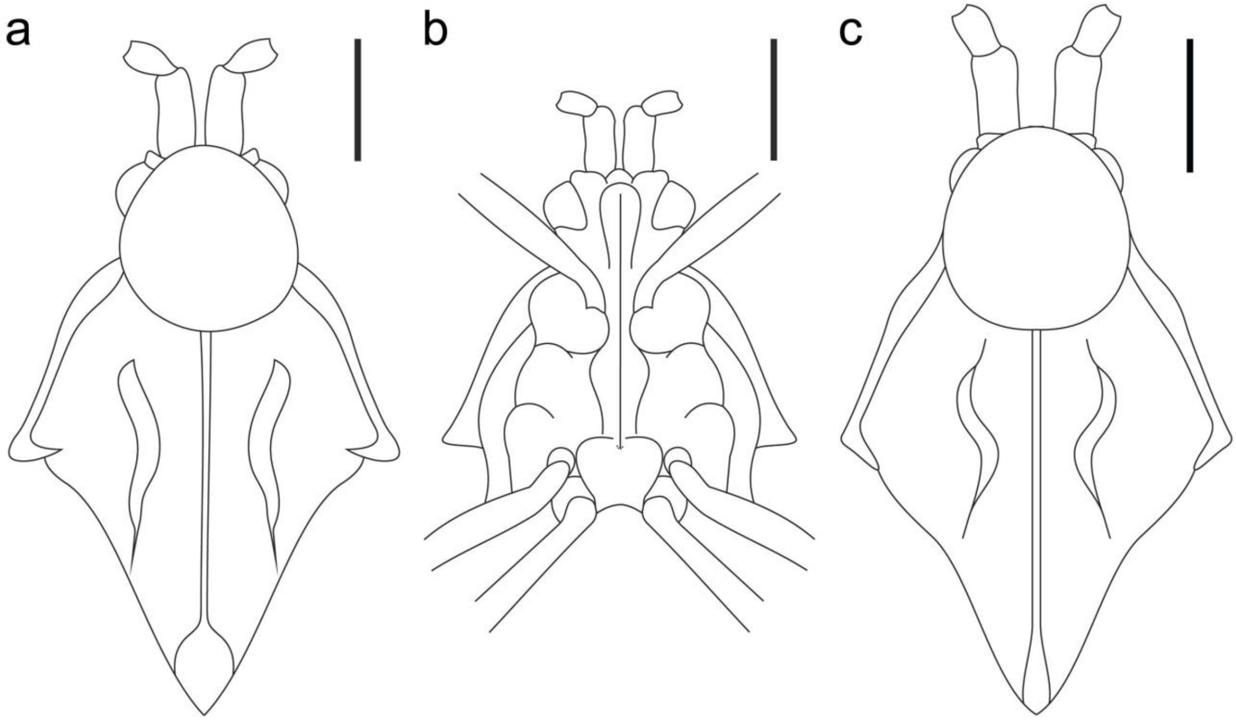

Fig. 3. Pronotum and paranota of *Sphaerocysta costai* n. sp. and *S*. *angulata*. (a) *S*. *costai* n. sp., dorsal view; (b) *S*. *costai* n. sp., ventral view; (c) *S*. *angulata*, dorsal view. Scale bar: 0.25 mm.

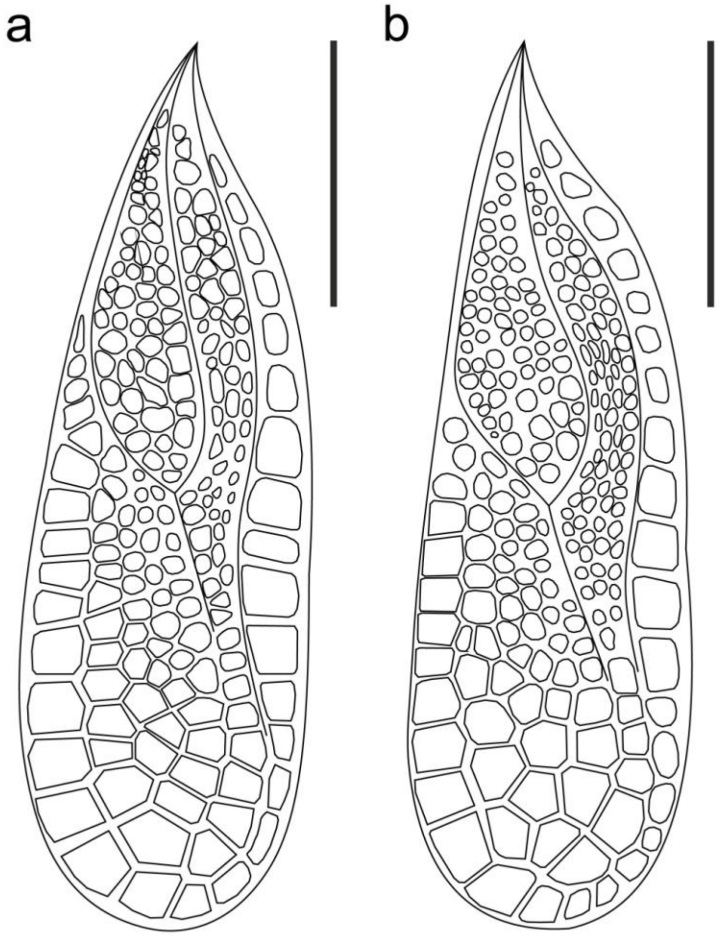

Fig. 4. Hemelytra of *Sphaerocysta costai* n. sp. (a) *S*. *costai* n. sp., male; (b) *S*. *costai* n. sp., female. Scale bar: 0.5 mm.

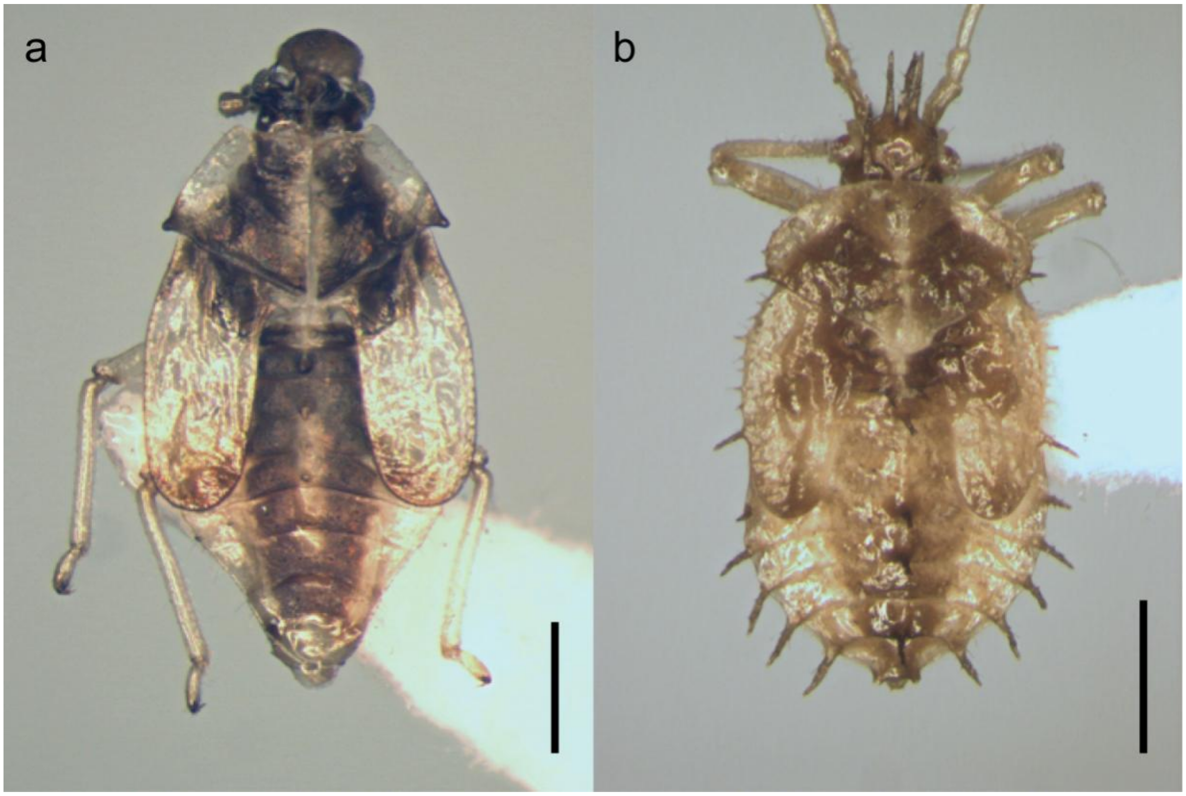

Fig. 5. Dorsal habitus of the fifth instar of *Sphaerocysta costai* n. sp. and of *S*. *angulata*.

(a) exuvie of *S*. *costai* n. sp.; (b) nymph of *S*. *angulata*. Scale bar: 0.5 mm.

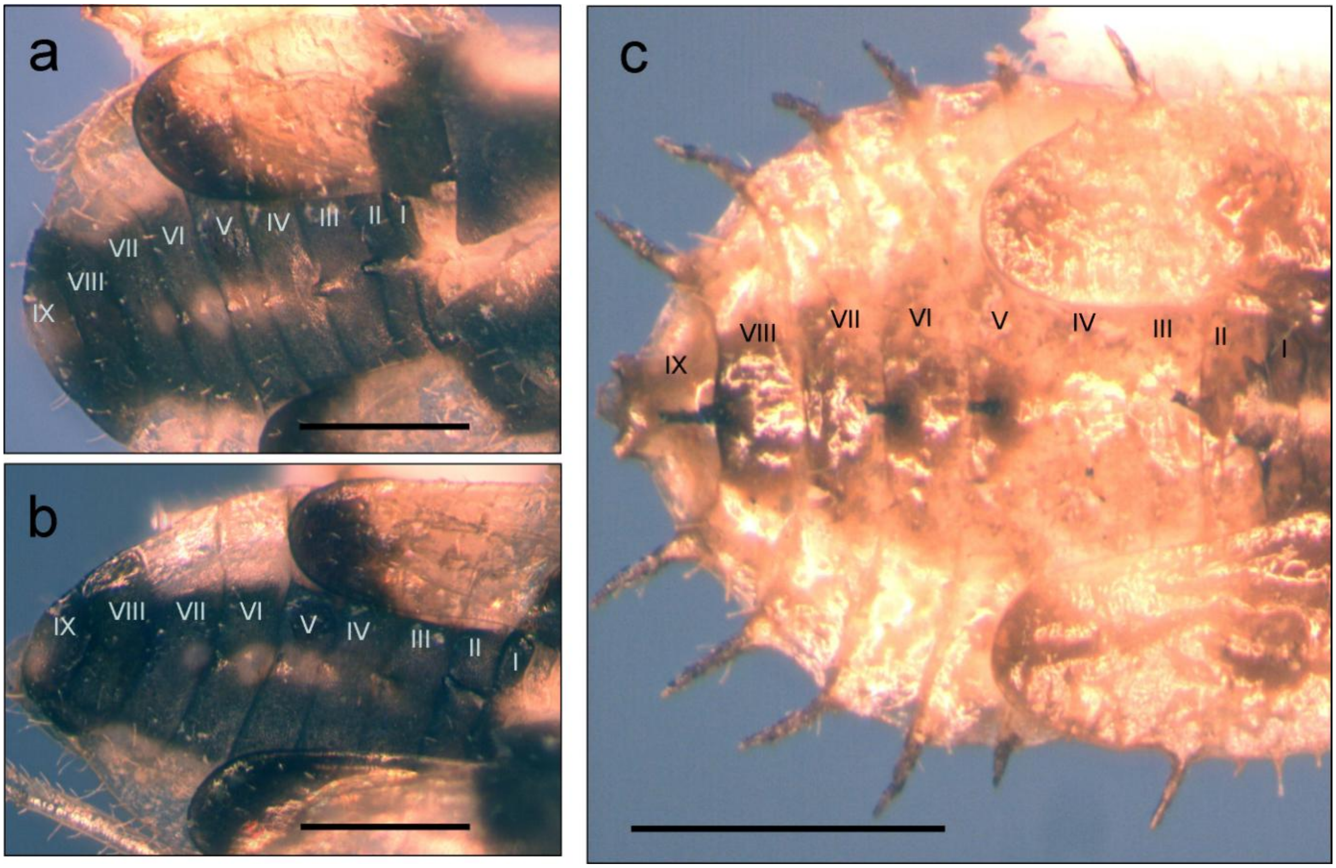

Fig. 6. Median abdominal tubercles on fifth intar of *Sphaerocysta costai* n. sp. and *S*. *angulata*. (a, b) exuvie of *S*. *costai* n. sp.; (c) nymph of *S*. *angulata*. Scale bar: 0.5 mm.

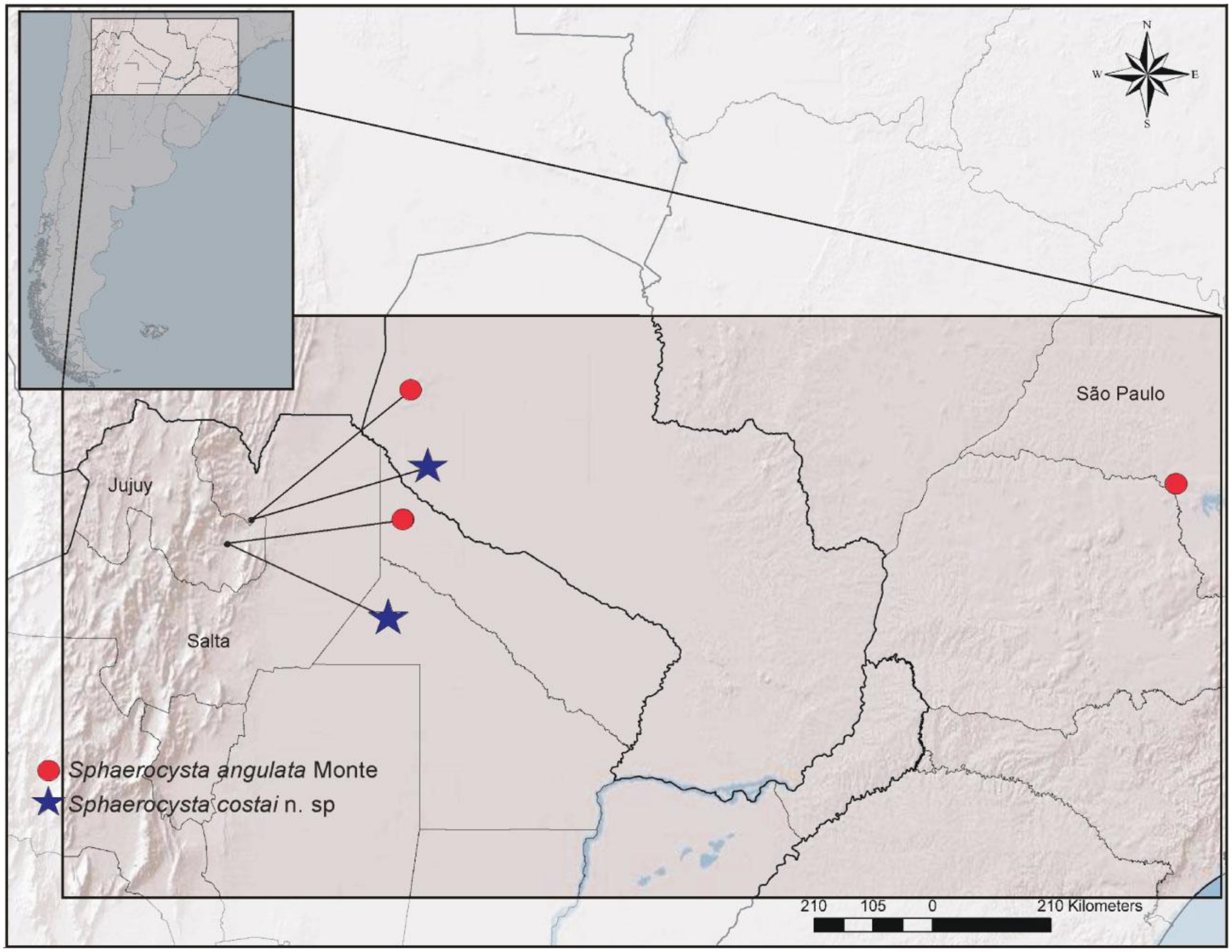

Fig. 7. Distribution map of *Sphaerocysta costai* n. sp. and *S. angulata*.

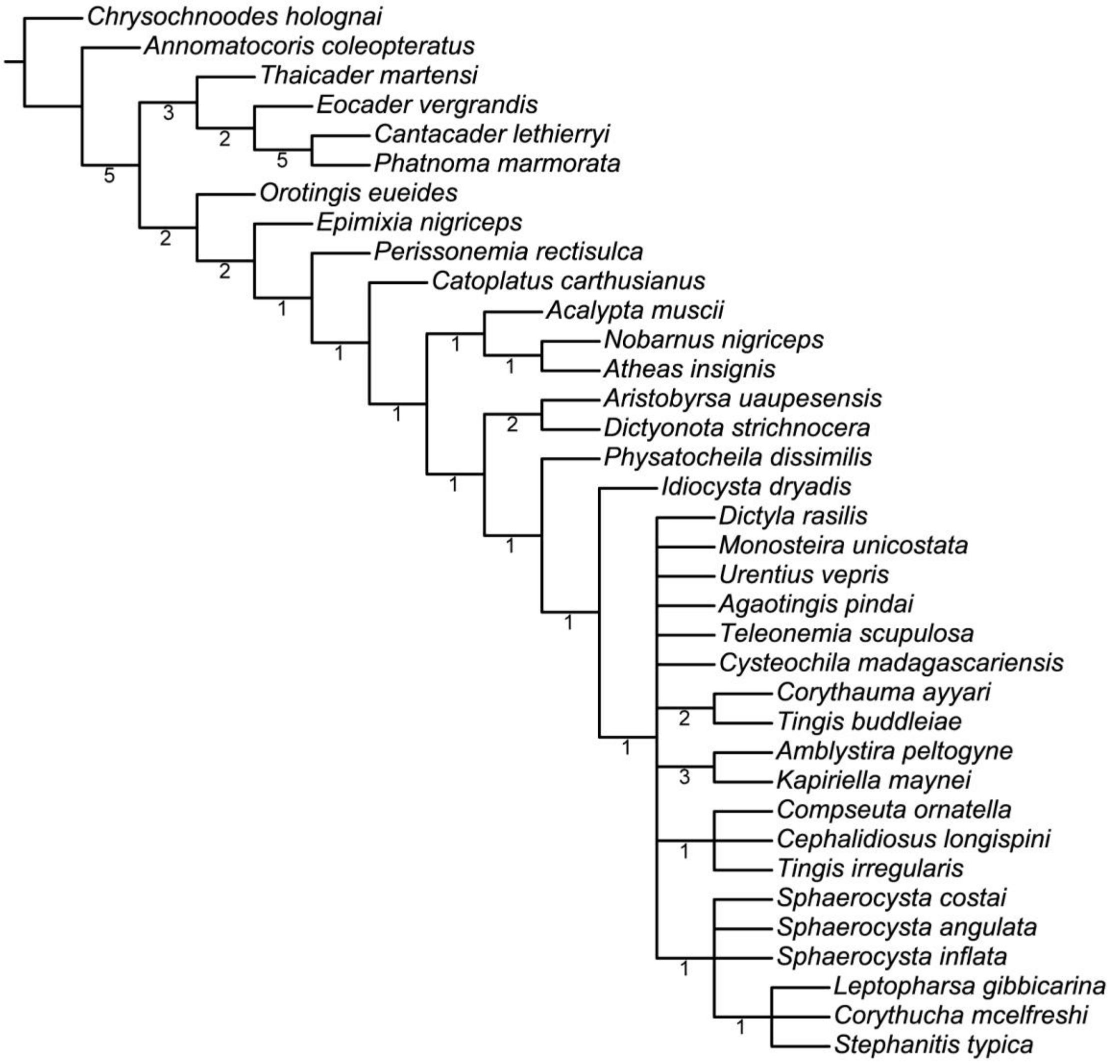

Fig. 8. Consensus tree of the full data set analysis (length = 317; consistency index = 0.38; retention index = 0.58). The numbers below branches are Bremer support values.

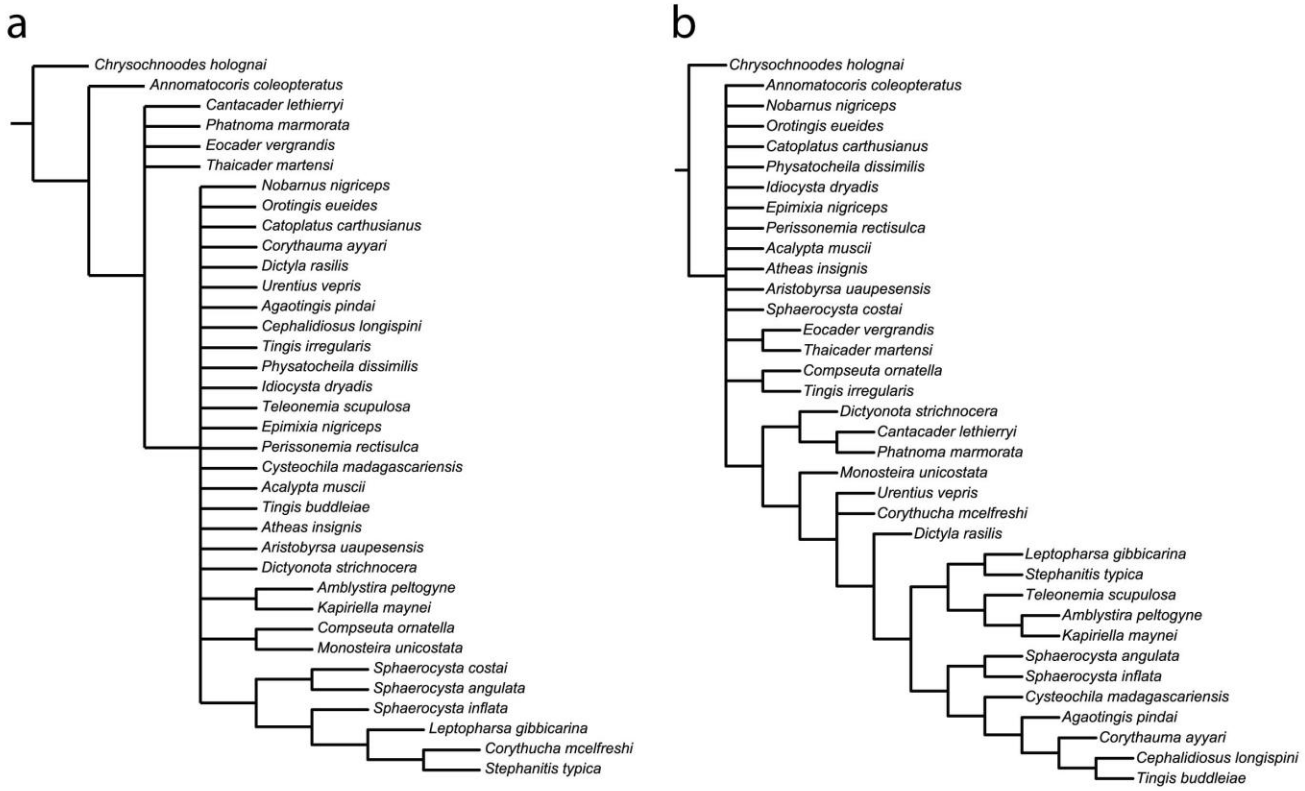

Fig. 9. Strict consensus tree of the partitioned data set analyses. (a) adult characters only (length (L) = 166; consistency index (CI) = 0.26; retention index (RI) = 0.34); (b) nymphal characters only (L = 155; CI = 0.42; RI = 0.62).

Capítulo 2

Phylogenetic analysis and taxonomic revision of the neotropical lacebug genus *Sphaerocysta* (Heteroptera: Tingidae), with the description of a new species

Marcus Guidoti, Aline Barcellos & Augusto Ferrari

Abstract

A taxonomic review and a phylogenetic analysis are conducted in order to improve the knowledge on the systematics of a South American genus *Sphaerocysta* (Heteroptera, Tingidae). The parsimony analysis was based on a matrix with 84 characters and 31 taxa, and recovered one most parsimonious tree with 272 steps. The monophyly of *Sphaerocysta* was corroborated with *Dicysta* as its sister-group. Two homoplastic synapomorphies supported the monophyly of the genus: posterior angle of the paranota lobulated and the apex of the Cu vein slightly curved. The most phylogenetically related taxon with the clade *Dicysta* + *Sphaerocysta* was the Paleartic *Galeatus spinifrons*. A new species is described and redescriptions for the remaining species of *Sphaerocysta* as well as for the genus are provided. *Sphaerocysta maculata* was considered as junior synonym of *S. propria*, and a discussion towards the taxonomic status of *S. brasiliensis*, *S. globifera*, *S. propria* and *S. stali* is given. New distributional records are also reported, expanding the geographical range of the genus to Central America.

Keywords: Description; Morphology; Phylogenetic analysis; Redescription; Synonimy.

Introduction

Sphaerocysta Stål, 1873 (Heteroptera, Tingidae) is a Neotropical lacebug genus described to accommodate two species originally placed in *Tingis* Fabricius, 1803: *T. globifera* Stål, 1858 and *T. inflata* Stål, 1858 (Drake & Ruhoff, 1965). *Sphaerocysta globifera* (Stål, 1858) is the type-species, and currently this genus comprises 12 species, all restricted to South America. Except for *S. nosella* Drake & Hambleton, 1945, all the others species occur in Brazil (Guidoti & Montemayor, in prep). *Sphaerocysta inflata* (Stål, 1858) and *S. globifera* are additionally present in Paraguay, the former also occurs in Bolivia and Argentina (Drake & Ruhoff, 1965). This genus can be recognized by the subspherical hood, the presence of a posterior pronotal cyst (except in *S. egregia* Drake, 1928a), and the elevated posterior part of the discoidal region in the hemelytra (Guidoti & Montemayor, in prep). All host plant records for *Sphaerocysta* was of species of Bignoniceae (Drake & Ruhoff, 1965).

Historically, the taxonomy of the genus has not undergone many alterations. Drake & Ruhoff (1961) synonimized *S. romania* Drake, 1947 with *S. paris* Drake, 1939. Ashmead, in 1887, described *S. peckami*, which was later transferred to *Galeatus* Curtis, 1833. Both *Sphaerocysta* and *Galeatus* have very remarkable differences which allow one to say that the Ashmead decision was clearly mistaken. Later, *G. peckami* (Ashmed,

1887) was considered junior synonym of *G. spinifrons* (Fallén, 1807). Besides the two species described by Stål, the others have authorship of Carl Drake and collaborators or Oscar Monte (Drake & Ruhoff, 1965). These two authors have engaged in unfriendly arguments in the late 1930's (Oliver, 2005). After these disagreements, they stopped the exchange of their type materials. Half of the species of *Sphaerocysta* were described during this time where the authors had no contact with the type-material of each other. This situation directly affected the taxonomy of other genera (e. g., *Gargaphia* Stål, 1873 – Guidoti, *in press*). It is expected that such situation between the two most prolific authors in the taxonomy of *Sphaerocysta* may affected the development of the knowledge on this genus.

There are just a few phylogenetic analyses of generic level in Tingidae (*e. g.*, Guilbert, 2000; Montemayor & Costa, 2009; Cassis & Symonds, 2011). The majority of the efforts to understand phylogenetic relationships were applied in suprageneric issues on the Tingidae systematics (Lis, 1999; Guilbert, 2001, 2004, 2012; Schuh, Cassis & Guilbert, 2006). Nevertheless, the only analysis of a Neotropical genus was conducted recently by Montemayor & Costa (2009). None of these analyses included species of *Sphaerocysta*, thus, there is no phylogenetic evidence about related groups of the genus in the literature. The absence of more Tingidae analyses hampers the development of a framework for such approach at generic level, which could provide characters lists and evidences in outgroup selection.

In this contribution, a taxonomic revision of *Sphaerocysta* is conducted after the study of the type-material of all species, as well as the cladistic analysis of the genus. We provided redescriptions of all species and a new species is here described. The new distributional data of these taxa, their taxonomic status as well as the cladistic analysis is discussed. Our main goal is address attention to the systematics of this genus, which could have been severely affected due old personal disagreements between the former specialists in Neotropical tingids.

Material and methods

Cladistics

A total 31 terminal taxa were included in the phylogenetic analysis. Thirteen species correspond to *Sphaerocysta* species, whereas the other 18 are outgroup taxa. Due the lack of evidence in previous phylogenetic analyses, the taxonomic sampling process was conducted according to the following criteria: 1) morphological resemblance; 2) taxonomic history; 3) availability of material. Taxa from the three tribes of Tinginae *sensu* Drake & Ruhoff, 1965 were included (Tinginae: *Dicysta amica* Drake & Hambleton, 1939, *D. fonsecai* Monte, 1940, *D. hollandi* Drake, 1922a, *D. lauta* Drake & Hambleton, 1935, *D. limata* Drake & Hambleton, 1939, *D. smithi* Drake, 1922a, *D. vitrea* Champion, 1897, *Galeatus spinifrons* (Fallén, 1807), *Leptocysta sexnebulosa* (Stål, 1858), *Leptocysta novatis* (Drake, 1928b), *Teleonemia scrupulosa* Stål, 1873, *Tingis americana* Drake, 1922b, *Tingis colombiana* Drake, 1929, *Ulotingis decor* Drake & Hambleton, 1935, *U. nitoris* Drake & Hambleton, 1935; Ypsotingini: *Derephysia* *foliacea* (Fallén, 1807), *Kalama tricornis* (Schrank, 1801); Litadeini: *Psilobyrsa vriesiae* Drake & Hambleton, 1935). *Galeatus spinifrons*, *K. tricornis* and *Derephysia foliacea* have a Paleartic distribution. *Psilobyrsa vriesiae* was chosed as the root. We decided to follow Drake & Ruhoff (1965) definitions of tribes because the lack of agreement between authors in the recent discussion on these suprageneric groups (Lis, 1999; Guilbert, 2001, 2012; Schuh *et al.*, 2006). *Dicysta* Champion, 1897 have more species included than the others outgroup genera due a Monte's handwritten label, which indicated his thoughts towards a possible transfer of *D. smithi* to *Sphaerocysta* (first author's personal observation). A total of 84 characters were included, 11 characters extracted from literature (Lis, 1999; Guilbert, 2000, 2001, 2004; Montemayor & Costa, 2009; Cassis & Symonds, 2011). The characters are distributed as follows: 19 characters of head, 62 of thorax (18 of hemelytra), and three of abdomen (Appendix 1). All the characters statements follows Sereno (2007). All characters were equally weighted and multistate characters were considered non-additive. The matrix was built on Mesquite (version 2.75, Maddison & Maddison, 2011) and non-applicable characters and missing data were represented as "-" and "?", respectively (Table 1). The parsimony analysis was conducted with the software TNT (Goloboff *et al.*, 2008), using tree bisection reconnection as the swapping algorithm. The parameters for the traditional search were: random seed equal zero, 1000 replicates saving 100 trees per replicate. Absolute bremer (B) and jacknife GC (J) were used as branch support, and their values are represented above and below each branch, respectively. Winclada (Nixon, 2002) was used to extract the most parsimious tree.

Taxonomy

Specimens belonging to 19 scientific instutitions and collections were consulted (Table 2). Type-material of all species of *Sphaerocysta* was studied, with the exception of *S. globifera* and *S. inflata*. They were accessed throught high-resolution photographs provided by the Swedish Museum of Natural History (NHRS), where the types are hosted. The type of *S. ruthae* n. sp. was deposited in the American Museum of Natural History (AMNH). Photographs were obtained by a digital camera attached to an estereomicroscope. Drawings were made from these photographs, which also were used to obtain measuruments in Image J software. The measures are given in milimeters, as follows: mean (minimum – maximum). These data were also obtained with measuring reticle when photographs were not available. The terminology applied in the descriptions and in the identification key follows Drake & Davis (1960). This identification key was constructed manually, after carefull study of the type-material and original descriptions.

Results

Cladistics

The cladistic analysis resulted in one most parsimonious tree of 272 steps (CI = 0.46; RI = 0.68), almost fully resolved, with only one polytomy (Fig. 1). *Sphaerocysta* was recovered as a monophyletic group (B = 1; J = 21), and it is supported by two homoplastic synapomorphies (HS): posterior angle of the paranota lobulated (character 54, state 2: 54-2) and the apex of the Cu vein slightly curved (72-1). *Sphaerocysta ruthae* n. sp. is the sister group of all the other species of this genus. Then, the following sequence can be observed: *S. fumosa* Drake, 1928a, *S. biseriata* Drake, 1928a, *S. inflata* and *S. nosella*. *Sphaerocysta nosella* is the sister group of the polytomy recovered in this phylogenetic tree (B = 5; J = 83), involving *S. paris*, *S. egregia*, *S. angulate, S. costai* Guidoti & Montemayor, *S. brasiliensis* Monte, 1938, *S. propria* Drake & Poor, 1939, *S. globifera* and *S. stali* Drake, 1928a. This clade is supported by one synapomorphy and five HS, as respectively follows: presence of the conspicuously larger areolas on the postero-ventral area of the hood (28-1); absence of the medial cephalic spine (8-0), paranota not projected (46-0), with a straight posterior angle (54-0), anterior margin of hemelytra not folded (64-0), subrounded abdomem (82-1). The clade *S. angulata* + *S. costai* (B = 1; J = 59), as well as the group *S. brasiliensis* + *S. propria* (B = 1; J = 61) , was maintained by only one HS, whereas *S. globifera* + *S. stali* (B = 2; J = 55) was supported by two, as follows: posterior angle of paranota acutely projected (54-3); mesosternal laminae concave (59-1); posterior angle of paranota rounded (54-1) and outer row of areolas on the subcostal area smaller than the areolas of the inner row (76-0). The clade formed by *S. brasiliensis* + *S. propria* and *S. globifera* + *S. stali* (B = 2; J = 53) was supported by two synapomorphies and one HS: hood thin at the anterior region (22-1), presence of the conspicuously larger areolas on the postero-dorsal area of the hood (26-1) and same number of rows of areolas over the entire paranota (52-0), respectively. Two HS are responsible to maintain *S. angulata* + *S. costai* closely related to the aforementioned clade (B = 2; J = 81): areolas of the hood bigger than the areolas/punctuation of the pronotum (24-0) and areolas on median carina present only at the pronotal posterior projection (38-2).

In addition to the results on the species relationships within *Sphaerocysta*, all the outgroup genera which have more than one taxa added were recovered as monophyletic groups (*Tingis*, *Ulotingis* Drake & Hambleton, 1935, *Leptocysta* Stål, 1873). *Dicysta*, with seven species included, was also recovered as a monophyletic taxon (B = 2; J = 66), supported by tree HS: distiflagellomere and basiflagellomere with the same color (3-0), one pronotal carina (35-0) and squared areolas on the sternal laminae (56-1). With the support of 7 HS this genus was the sister-group of *Sphaerocysta* (B = 5; J = 64). These characters are: antenniferous process not acuminated (5-0), directed forward (6-0), occipital cephalic spines absent (7-0), outer row of the bucculae areolas equal in size to the inner row of areolas (17-0), hood oval (21-1), paranota posteriorly projected (46-2) and the junction of RM+Cu veins strongly raised forming a cyst (71-2). The sister group of *Dicysta* + *Sphaerocysta* was *G. spinifrons* (B = 4; J = 42), supported by one synapomorphy and four HS: areolas on lateral carina only at the pronotal disc (42-1); cyst on the posterior pronotal projection present (33-1), areolas on the sternal laminae wider than longer (56-0), discoidal length smaller to half of the hemelytra length (73-0) and posterior cells of costal area larger than the average size of the areolas of the sutural area (75-2), respectively.

***SPHAEROCYSTA* STÅL, 1873**

Sphaerocysta Stal, 1873: 120, 128; Lethierry & Severin, 1896: 15; Drake, 1928: 42; Monte, 1939: 78; 1941: 129; Drake & Ruhoff, 1960: 82; 1965: 350; Guilbert & Montemayor, 2010: 559; Guidoti & Montemayor (in prep).

Type species. *Sphaerocysta globifera* (Stål, 1858).

Description. Head with frontal pair of cephalic spines; medial sometimes present. Bucculae closed in front, except in *S. ruthae* n. sp. Postero-orbital plate present, lighter than the head. Rostrum reaching at least the posterior region of the mesosternum; apex black. Hood spherical, oval only in *S. ruthae* n. sp. Median carinae areolated also on pronotal disc, ending in a cyst on the posterior projection of pronotum, except in *S. egregia*. Lateral carina present, except in *S. fumosa*. Paranota areolated; shape and number of cells' rows vary. Mesosternal laminae widening; metasternal laminae narrowing. Legs light yellowish, with few and short hairs. Hemelytra light brownish; hemelytra cyst slightly darker. Costal area uniseriated or biseriated from the beginning; subcostal and discoidal area wider at the higher region of hemelytra cyst, with areolas similar in size; radius-media curved posteriorly; sutural area with smaller cells anteriorly, similar in size to those of the distal part of the discoidal area; larger subsquared cells posteriorly, these usually smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Distribution (Fig. 2). ARGENTINA (Chaco; Jujuy; Missiones; Salta); BOLIVIA (Beni); BRAZIL (Bahia; Goiás – new record; Mato Grosso; Mato Grosso do Sul; Minas; Pará; Paraná; Rio de Janeiro; Rio Grande do Sul; Santa Catarina; São Paulo); ECUADOR (Los Rios); PANAMA (Los Santos) – new record; PARAGUAY (Alto Parana; La Cordillera); VENEZUELA – new record.

Key to species of Sphaerocysta

1. Cells of the outer row of paranota larger than the ones of the inner row, or paranota with only one row of cells 2
1'. Paranota with at least two rows of cells, these with similar size............................. 3

2. Size of areolas unequal in the dorsal part of the hood. ....*S. nosella*
2'. Size of areolas subequal in the dorsal part of the hood 3

3. Lateral carina absent..*S. fumosa*
3'. Lateral carina present.. 4

4. Hood oval .... *S. ruthae* n. sp.
4'. Hood spherical 5

5. Hemelytra with 11-12 lines of cells in the costal area before the rounded posterior region; abdomen reaching the middle of the hemelytra..............................*S. biseriata*
5'. Hemelytra with 6-9 lines of cells in the costal area before the rounded posterior region; abdomen conspicuously surpassing the middle of the hemelytra.........*S. inflata*

6. Cyst on the posterior pronotal projection absent ....*S. egregia*
6'. Cyst on the posterior pronotal projection present 6

7. Cyst on the posterior pronotal projection almost as high as the hood, slightly higher or lower 7
7'. Cyst on the posterior pronotal projection conspicuously lower than the hood *8*

8. Hood triangular anteriorly; paranota entirely biseriate, with areolas of similar size; cyst on the posterior pronotal projection higher than the hood.......................... *S. stali*
8'. Hood rounded anteriorly; paranota irregularly biseriate, with areolas slightly different in size; cyst on the posterior pronotal projection lower than the hood ....*S. globifera*

9. Humeri projected, triangular 9
9'. Humeri not projected, rounded.. 10

10. Humeri triangular; areolas of lateral carina not fully-developed ....*S. angulata*
10'. Humeri strongly triangular; areolas of lateral carina fully-developed, two rows at the highest part ....*S. costai*

11. Paranota constricted in the middle line ....*S. paris*
11'. Paranota without any constriction 11

12. Costal area of hemelytra regularly biseriate anteriorly .... *S. brasiliensis*
12'. Costal area of hemelytra irregularly bisseriate anteriorly, or uniseriate .*S. propria*

SPHAEROCYSTA ANGULATA MONTE, 1941 (Fig. 3a)

Sphaerocysta angulata Monte, 1941: 373, figure 1; Drake & Ruhoff, 1965: 351; Guilbert & Montemayor, 2010: 559; Guidoti & Montemayor (in prep).

Material examined. Paratypes: BRAZIL, **São Paulo**: #m, #f, Chavantes, 13.v.1941, Oscar Monte (MNRJ).

Description. General color light brownish, brownish on hood, pronotal disc, top of the hemelytra cyst and posterior region of hemelytra (Fig. 3a). Scape twice as longer than pedicel; same color. Basiflagellomere about four times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of the mesosternum; apex darker. Hood spherical; areolas uniform, subequal in size to the pronotal disc punctures. Median carinae areolated also on pronotal disc, ending in a small cyst on the posterior projection of pronotum, conspicuously lower than hood; one full-developed small cell right before cyst. Lateral carina anteriorly thin then strongly thick, sinous, areolated; higher at the pronotal disc. Paranota uniformly areolated, with one row of areolas; anterior region wider and less elevated than the median region; posterior region widest, completely elevated, triangled-shaped. Mesosternal laminae widening, almost straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs. Hemelytra light brownish; hemelytra cyst slightly darker at the very top. Widening anteriorly, widest right after discoidal area. Costal area uniseriated from the beginning; subcostal area with two rows of areolas anteriorly, four in the widest part at the higher region of hemelytra cyst; discoidal area with five rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to the ones of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, subequal in size to those of the distal part of the discoidal area; larger subsquared cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.192 (0.192); pedicel length: 0.098 (0.096 – 0.100); bastiflagellomere length: 1.154 (1.154); distiflagellomere length: 0.308 (0.308); discoidal area length: 0.819 (0.781 – 0.857); total body length: 2.450 (2.417 – 2.483); total body width: 0.892 (0.846 – 0.938); hood height: 0.392 (0.385 – 0.400); posterior pronotal cyst height: 0.108 (0.100 – 0.115).

Distribution (Fig. 2a*).* ARGENTINA (Jujuy; Salta – new record); BRAZIL (São Paulo).

Comments. This species is strongly similar to *S. costai*, since both are the only species with the posterior angle of paranota triangled-shaped. However, these paranota angle are conspicuously more developed in *S. costai*. In addition, the lateral carina are more thicker than the ones of *S. costai*, and the immatures presents remarkable morphological difference (Guidoti & Montemayor, in prep).

SPHAEROCYSTA BISERIATA **DRAKE, 1928 (Figs. 3b, 4a)**

Sphaerocysta inflata var. *biseriata* Drake, 1928: 43.

Sphaerocysta biseriata Drake & Hambleton, 1934: 438; Drake & Ruhoff, 1965: 351; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, [**Mato Grosso**]: #m, Chapada, iv.??, no collector, “Acc. No. 2966”, “C.J. Drake Coll. 1956” (Carnegie Museum/Biseriata_type). Paratype: Same locality, sex undefined, no date, no colletor, “Acc. No. 2966”, “Paratype by C.J. Drake, S. inflata var. biseriata”, “C.J. Drake Coll 1956” (USNM/Biseriata_001).

Description. General color hyaline, brownish hood, pronotal disc and cyst, and some hemelytra parts (Fig. 3b). Scape two times the length of pedicel; subequal in color. Basi- and distiflagellomere lacking. Head with three spines (frontal pair and medial); bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of mesosternum; apex darker. Hood spherical, central vein darker; areolas uniform, conspicuously bigger than the pronotal disc punctures. Median carinae higher than lateral carina, areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, higher than hood; three subequal cels right before cyst. Lateral carina concave, areolated. Paranota areolated, posteriorly projected; median and posterior region subequal in width and wider than anterior region; two rows of areolas; the outer row of areolas at least twice the size of the inner row of areolas. Mesosternal laminae widening, almost straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra hyaline, presenting two stains: one at the hemelytra cyst, excluding the very top of the cyst and other on the posterior region of sutural area. Outer margin folded anteriorly; then uniformly widening posteriorly; widest at sutural region. Costal area biseriated from the beginning (Fig. 4a); inner row of areolas subrectangular, smaller than the ones of the outer row, these rectangular; subcostal area with two rows of areolas, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, located at the same position than the widest part of the subcostal area, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, similar in size with those of the distal part of the discoidal area; larger subsquared cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.269 (0.258 – 0.280); pedicel length: 0.093 (0.089 – 0.097); discoidal area length: 0.972 (0.899 – 1.044); total body length: 3.507 (3.390 – 3.625); total body width: 1.402 (1.330 – 1.474); hood height: 0.444 (0.428 – 0.498); posterior pronotal cyst height: 0.471 (0.443 – 0.498).

Distribution (Fig. 2a). BRAZIL (Mato Grosso).

Comments. This species is morphologically similar to *S. inflata*, and it can be distinguished mostly by the the costal area entirely biseriated (Fig. 4a). *Sphaerocysta* *biseriata* was firstly described as a variety of *S. inflata*, due the high morphological resemblance.

SPHAEROCYSTA BRASILIENSIS MONTE, 1938 (Figs. 3c, 5a)

Sphaerocysta brasiliensis Monte, 1938: 64, figure; 1939: 516, figure; Drake & Ruhoff, 1965: 351; Guidoti & Montemayor (in prep).

Material examined. Paratype: BRAZIL, **Rio de Janeiro**: #m, Rio de Janeiro, Guaratiba, no date, A. Silva (MNRJ). BRAZIL, Rio de Janeiro: #m, Rio de Janeiro, 12.xii.1922, W.S.B. (USNM/Brasiliensis _001); #f, Guaratiba, 25.iv.1937, Aristoteles Silva, “cotype”, “Def. San. Veg., Monte, 4221”, “C.J. Drake Coll. 1956” (USNM/Brasiliensis _002); no locality, sex undefined, Km 47, 7.ix.1948, Oscar Monte (MNRJ).

Description. General color light brownish, darker on hood, pronotal disc, top of the hemelytra cyst and posterior region of hemelytra (Fig. 3c). Scape twice as longer than pedicel; same color. Basiflagellomere about four times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of the mesosternum; apex darker. Hood spherical, tapering anteriorly; central vein darker; areolas uniform, subequal in size to the pronotal disc punctures, except two postero-dorsal and two postero-ventral conspicuously larger cells; postero-dorsal cells close to the central vein. Median carinae areolated also on pronotal disc, ending in a small cyst on the posterior projection of pronotum, conspicuously lower than hood; one full-developed small cell right before cyst. Lateral carina anteriorly thin then strongly thick, sinous, areolated; higher at the pronotal disc. Paranota areolated, mostly uniseriated; irregularly biseriated in the anterior region, this wider and less elevated than the median and posterior regions. Mesosternal laminae widening, slightly concave; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra light brownish; hemelytra cyst slightly darker at the higher part. Widening anteriorly, widest right after discoidal area. Costal area mostly biseriated in the anterior region (Fig. 5a); inner row of areolas conspicuously smaller than the ones of the outer row; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to the ones of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, slightly bigger than the those of the distal part of the discoidal area; larger subsquared cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.177 (0.169 – 0.185); pedicel length: 0.092 (0.088 – 0.096); bastiflagellomere length: 1.112 (1.108 – 1.115); distiflagellomere length: 0.292 (0.277 – 0.308); discoidal area length: 0.900 (0.877 – 0.923); total body length: 2.783 (2.733 – 2.833); total body width: 1.188 (1.108 – 1.269); hood height: 0.354 (0.338 – 0.369); posterior pronotal cyst height: 0.169 (0.154 – 0.185).

***Distribution* (Fig. 2a).** BRAZIL (Rio de Janeiro).

Comments. This species is strongly similar to *S. propria* since these taxa shares the larger areolas close to the central vein of the hood, the posterior pronotal cyst small and the general body size and the shape of the hemelytra. *Sphaerocysta brasiliensis* could be separated from this congeneric by the anterior region of the costal area, biseriated in in *S. brasiliensis* (Fig. 5a).

SPHAEROCYSTA COSTAI **GUIDOTI & MONTEMAYOR (Figs. 3d, 6a)**

Sphaerocysta costai Guidoti & Montemayor (in prep).

Material examined. Holotype: ARGENTINA, **Jujuy,** #m, Calillegua, 23º 44 46' S 64º 51 186' W, 800m, 04.VI.2007, Montemayor col. (MLPA). Paratypes: same data as holotype, #m (MLPA); same data as holotype, #f, É. Guilbert réc. (MNHN); **Salta**, Urundel, 23°26 638’S 64°30 428’W, 575m, 07.VI.2007, Guilbert & Montemayor col.

(MLPA).

Description. Recently described in Guidoti & Montemayor (in prep).

Measurements. Guidoti & Montemayor (in prep).

Distribution (Fig. 2b). ARGENTINA (Jujuy; Salta).

Comments. See *S. angulata* “comments”.

SPHAEROCYSTA EGREGIA **DRAKE, 1928 (Figs. 3e, 6b)**

Sphaerocysta egregia Drake, 1928: 44; Drake & Ruhoff, 1965: 351; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, Mato Grosso [do Sul]: #m, Corumbá, iii, no collector, “Acc. No. 2966”, “C.J. Drake Coll. 1956” (Carnegie Museum/Egregia_type).

Description. General color light brownish, darker on hood, pronotal disc and on top of the hemelytra cyst. Scape slightly longer than pedicel; same color (Fig. 3e). Basiflagellomere about three times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas. Postero-orbital plate present, lighter than the head. Rostrum slightly surpassing the middle of the mesosternum; apex darker. Hood spherical; areolas uniform, conspicuously bigger than the pronotal disc punctures. Median carinae areolated also on pronotal disc; pronotal cyst absent. Lateral carina concave, areolated. Paranota median-constricted; areolated only at the anterior region; anterior region wider than the median and posterior regions (Fig. 6b); median and posterior region almost carina-like, elevated; anterior region not elevated. Mesosternal laminae widening, almost straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs. Hemelytra light brownish; hemelytra cyst slightly darker at the very top. Widening anteriorly, widest right after discoidal area. Costal area biseriated; inner row's and outer row's of areolas subequal in size and subsquared; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, slightly bigger than the those of the distal part of the discoidal area; larger subrectangular cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.175; pedicel length: 0.082; bastiflagellomere length: 0.783; distiflagellomere length: 0.267; discoidal area length: 0.952; total body length:

2.927; total body width: 1.620; hood height: 0.256.

Distribution (Fig. 2a). BRAZIL (Mato Grosso do Sul).

Comments. *Sphaerocysta egregia* differs from all of its congeneres by the lack of the posterior pronotal cyst and by the shape of the paranota, conspicuously more developed at the anterior region (Fig. 6b).

SPHAEROCYSTA FUMOSA DRAKE, 1928 (Figs. 3f)

Sphaerocysta fumosa Drake, 1928: 44.; Drake & Ruhof, 1965: 351; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, **Pará**: #f, Paracary [Panacari?], viii, no collector. "acc. No. 2966" (USNM/Fumosa_type). Additional material: PANAMA: **Los Santos**: #f, La playa, 1.5 km N Pedasi, 07º33' N, 80º01' W, 21.vi.1973, Erwin & Hevel, Central American Expedition (USNM/fumosa_MP001); VENEZUELA: #f, 7.ii.1983, "Intercepted on air [frgight] from Venezuela feb.7.1983", "C.J. Drake Coll. 1956" (USNM/fumosa_MP002).

Description. General color hyaline, brownish hood, pronotal disc and cyst, and some hemelytra parts (Fig. 3f). Scape two times the length of pedicel; subequal in color.

Basiflagellomere three times the disitiflagellomere length; the last with a apex darker. Head with three spines (frontal pair and medial); bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of mesosternum; apex darker. Hood oval, central vein darker; areolas uniform, conspicuously bigger than the pronotal disc punctures. Median carinae areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, slightly higher than hood; one cel right before cyst. Lateral carina absent. Paranota areolated, posteriorly projected; median and posterior region subequal in width and wider than anterior region; two rows of areolas; the outer row's areolas at least three times the size of the inner row's areolas. Mesosternal laminae widening, almost straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra hyaline, presenting two stains: one at the hemelytra cyst and other on the posterior region of sutural area; costal area lateral veins also darker. Outer margin folded anteriorly; then uniformly widening posteriorly; widest at sutural region. Costal area entirely biseriated; inner row's areolas subrectangular, slightly smaller than the ones of the outer row, these rectangular; subcostal area with two rows of areolas, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, located at the same position than the widest part of the subcostal area, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, similar in size with those of the distal part of the discoidal area; larger subsquared cells posteriorly, almost half the length than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.212 (0.205 – 0.226); pedicel length: 0.082 (0.077 – 0.092); bastiflagellomere length: 1.248 (1.238 – 1.257); distiflagellomere length: 0.284 (0.266 – 0.302); discoidal area length: 0.957 (0.868 – 1.017); total body length: 3.222 (2.931 – 3.385); total body width: 1.445 (1.368 – 1.513); hood height: 0.481 (0.423 – 0.519); posterior pronotal cyst height: 0.438 (0.410 – 0.451).

Distribution (Fig. 2b). BRAZIL (Pará); PANAMA (Los Santos) – new record; VENEZUELA – new record.

Comments. *Sphaerocysta fumosa* is the only species of this genus that lacks the lateral carina. The pranota and hemelytra shape resembles *S. inflata* and its other similar species, such as *S. biseriata* and *S. ruthae* n. sp.

SPHAEROCYSTA GLOBIFERA (STÅL, 1858) (Figs. 6c, 7a, 8a, 9a)

Tingis globifera Stål, 1858: 65; Walker, 1873: 181.

Sphaerocysta globifera Stål, 1873: 128; Drake, 1929: 35; 1930: 25; 1935: 11; Drake & Hambleton, 1934: 438; Costa Lima, 1936: 130; Drake & Poor, 1937: 305; Silva, 1956:

48, figures 18, 18a; Drake & Ruhoff, 1965: 351; Guidoti & Montemayor (in prep).

Material examined. No locality: #f, 4.xii.1952, Fritz Plaumann, “J.C. Lutz Collection, 1961” (USNM/Globifera_005); #m, 24.xii.1952, same collector, “J.C. Lutz Collection, 1961”(USNM/Globifera_004); BRAZIL, **Bahia**: #f, no data, “C.J. Drake Coll. 1956”, “1994”(USNM/Globifera_053); #f, no locality, no date, G. Bondar, “C.J. Drake Coll. 1956”, “994” (USNM/Globifera_054); 2 #m, 2 #f, Encruzilhada, x. 1975, M. Alvarenga (AMNH); **Minas Gerais**: #m, #f, Belo Horizonte, no date, Oscar Monte (MNRJ); 2 #m, Viçosa, 11.iv.1933, E.J. Hambleton (USNM/Globifera_037; 034); 8 #m, 13 #f, same locality and collector, 29.iv.1934 (USNM/Globifera_009−016; 023−029; 038−043); same locality, 9 #m, 2 #f, 13.x-1.xi.1985, T.J. Henry and P. S. Fiuza (USNM/Globifera_058−066; 071; 072); #m, #f, same county, Córrego do Paraíso, Mata da Prefeitura, 10.iii.1993, T.J. Henry (USNM/Globifera_067; 073); **Rio de Janeiro**: #m, Rio de Janeiro, Represa Rio Grande, viii.1972, F.M. Oliveira (AMNH); #f, same locality and collector, iii-iv.1972 (AMNH); **São Paulo**: #f, Guarari, 30.vii.1940, Monte, “J.C. Lutz Collection, 1961”(USNM/Globifera_095); 3 #m, #f, Ilha dos Búzios, 16.x-4.xi.1963, Exp. Dep. Zool. (MZSP); #f, Monte Alegre, Faz. N.S. Incarnação, 720m, 14-27.x.1943, L. Trav. & Almeida (MZSP); 4 #m, Taquaretinga, iii.1939, E.J. Hambleton, “J. C. Lutz Collection, 1961” (USNM/Globifera_084–087); **Paraná**: #m, Fazenda Monte Verde, 08.ix.1986, Levantamento Entomológico PROFAUPAR (DZUP); #m, #f, same locality and collector, 29.ix.1986 (UFPR); **Santa Catarina**: 3 #m, Nova Teutônia, 27º11' B, 52º23' L, 18.iv.1944, Fritz Plaumann (USNM/Globifera_088; 089; 091); #m, #f, same locality and collector, 24.v.1945 (MZSP); 9 #m, 8 #f, same data, no coordinates (USNM/Globifera_075−083; 097−104); #f, same locality and collector, 2.vii.1948 (MZSP); #m, same locality and collector, 28.vii.1948 (MZSP); #m, same locality and collector, 3.viii.1948 (MZSP); #m, #f, same locality and collector, 9.viii.1948 (USNM/Globifera_090; 096); #f, same locality and collector, 5.viii.1949 "C.J. Drake Coll. 1956" (USNM/Globifera_036); sex undefined, same locality and collector, 12.i.1950 (USNM/Globifera_002); #f, same locality and collector, 4.v.1952 (MZSP); 4 #m, 3 #f, same locality and collector, 5.xii.1952, "C.J. Drake Coll. 1956" (USNM/Globifera_019−022; 035; 051; 052); #f, same data, "J. C. Lutz Collection, 1961" (USNM/Globifera_003); #m and #f pinned together, same locality and collector, 24.xii.1952,"J. C. Lutz Collection, 1961", "homotype" (USNM/Globifera_001); 4#m, 7 #f, same locality and collector, v.1975 (DZUP); **Rio Grande do Sul**: #m, no data (USNM/Globifera_094); 3 #f, no data, "C.J. Drake Coll. 1956" (USNM/Globifera_034; 049; 050); 4 #f, no locality, no date, Stieglmayr (USNM/Globifera_030−033); 4 #m, 5#f, same data, "C. J. Drake Coll. 1956" (USNM/Globifera_006−008; 018; 044−048); #m, Butiá, 27.v.1982, H.A. Gastal (MCNZ/46768); #m, Caibaté, ii.1995, no collector (DZUP); 2 #m, 2#f, Charqueadas, Capão da Roça, 25.ix.2003, R. Ott, A. Barcellos (MCNZ/176355–176358); #f, Derrubadas, Parque Estadual do Turvo, 20.x.2004, 27°08'09.9" S, 53°52'32.11'W, L. Schmidt & L. Podgaisky (MCNZ/176788); #f, same locality, 27°11'18.3" S, 53°50'38.4"W, 05.v.2004, A. Barcellos, R. Ott & I. Heydrich

(MCNZ/176014); 2 #m, #f, same locality, no coordinates, descida para o Salto do Yucumã, 26.iv.2005, L. Schmidt (MCNZ/177551;177553; 177552); #m, #f, Maquiné, Est. Exp. Fepagro, i.2006, no collector (MCNZ/179609; 179608); #f, same locality, iv.2006 (MCNZ/179773); #m, Novo Hamburgo, 28.vii.1986, C.J. Becker (MCNZ/51946); 2 #f, same locality and collector, 1.vii.1988 (MCNZ 178767;178768); #f, Porto Alegre, 20.ix.1954, no collector (MGAP); 5 #m, 7 #f, same locality, 19.iv.1961, no collector (MGAP); #f, same locality, 19.iv.1963, no colllector (MGAP); 2 #f, same locality, afloramento próximo – ETE Ipanema, 17.ix.2003, R.Ott, A. Barcellos (MCNZ/54394; 54396); #m, #f, São Jerônimo, 8.vii.1982, E.H. Buckup (MCNZ/46962; 46967); 2 #m, Tapes, Fazenda Guará, 30°29'10"S, 51°22'34"W, 15.v.2003, Equipe Probio (MCNZ/54186; 54211); undefined sex and #f, Três Coroas, 15.xii.1976, E.H. Buckup (MCNZ/14280; 14279); #m, Triunfo, Parque Copesul, pórtico, 24.viii.2004, A. Barcellos, L. Schmidt (MCNZ/176492); #m, same locality, 6.i.2005, A. Barcellos (MCNZ/177302); #m, same locality and date, L. Schmidt (MCNZ/177303); #m, #f, same locality, 14.vi.2006, R. Ott, A. Barcellos (MCNZ/179480; 179474); #f, same locality, 18.iii.2009, A. Barcellos, D. Casagrande (MCNZ/180535); 3 #m, 6 #f, same locality, Parque Braskem [new name for Parque Copesul], 10.i.2012, A. Barcellos (MCNZ/181958;181961;181962; 181957;181959;181960;181963–181965); 4 #m, 4 #f, same locality and date, J. Krticka (MCNZ/181948;181949;181953;181954; 181950;181952;181955;181956); undefined sex, M. R. [Marcelino Ramos], 30.ix.1940, no collector (MCNZ/6498); ARGENTINA, **Misiones**: #m,, #f,, Parque Prov. Mocona, 27°09'185" S, 53°54'080"W, 20.iii.2011, Montemayor (MLPA/MLPHT0492; MLPHT0491); #m, MLPHT0493, #m, #f, same locality, 23.iii.2011, Dellapé (MLPA); PARAGUAY, **Alto Parana**: 3 #f, SE Naranjal, viii.1988, L.E. Pena G. (USNM/Globifera_068–070); **La Cordillera**: 2 #m, São Bernardino, no date, Fiebrig, “J.C. Lutz Colllection, 1961” (USNM/Globifera_092; 093); 2 #f, same data, “C.J. Drake Colll. 1956”, “994” (USNM/Globifera_055; 056).

Description. General color light brownish, darker on hood, pronotal disc, pronotal posterior cyst, top of the hemelytra cyst and posterior region of hemelytra (Fig. 7a). Scape twice as longer than pedicel; same color. Basiflagellomere about four times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of the mesosternum; apex darker. Hood spherical, tapering anteriorly; areolas uniform, subequal in size to the pronotal disc punctures, except two postero-dorsal and two postero-ventral conspicuously larger cells; postero-dorsal cells away from the central vein (Fig. 8a). Median carinae areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, slightly lower than the hood (Fig. 9a); two largely unequal cells right before cyst. Lateral carina anteriorly thin then strongly thick, sinous, areolated; higher at the pronotal disc. Paranota uniformly areolated, with one row of areolas; anterior region wider and less elevated than the median and posterior regions

(Fig. 6c). Mesosternal laminae widening, concave; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra light brownish; hemelytra cyst slightly darker at the very top. Widening anteriorly, widest right after discoidal area. Costal area mostly uniseriated and irregurlaly biseriated; inner row's areolas conspicuously smaller than the ones of the outer row; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst, the areolas of the row next to costal area smaller than the others; discoidal area with four rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to the bigger ones of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, slightly bigger than the those of the distal part of the discoidal area; larger subsquared cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.216 (0.190 – 0.232); pedicel length: 0.102 (0.093 – 0.110); bastiflagellomere length: 1.250 (1.049 – 1.405); distiflagellomere length: 0.344 (0.315 – 0.376); discoidal area length: 1.030 (0.912 – 1.163); total body length: 3.444 (3.326 – 3.752); total body width: 1.297 (1.233 – 1.387); hood height: 0.365 (0.347 – 0.378); posterior pronotal cyst height: 0.409 (0.364 – 0.461).

Distribution (Fig. 2b). BRAZIL (Bahia; Minas Gerais; Rio de Janeiro; São Paulo; Paraná – new record; Santa Catarina – new record; Rio Grande do Sul); ARGENTINA (Missiones) – new record; PARAGUAY (Alto Parana; La Cordillera).

Comments. The type-species of the genus resembles *S. stali* since both of these taxa shares the larger areolas placed far of the central vein of the hood, the high posterior pronotal cyst and the general body size and the shape of the hemelytra. *Sphaerocysta globifera* could be separated from this congeneric by the following characters: size of the larger areolas on the hood, bigger in *S. stali*; height of the posterior pronotal cyst, smaller than the hood in *S. globifera* (Fig. 9a) and higher than the hood in *S. stali*; size of the areolas on the posterior pronotal projection and in discoidal area of hemelytra, bigger in *S. stali*.

SPHAEROCYSTA INFLATA **(STÅL, 1858) (Figs. 4b, 6d, 7b, 8b)**

Tingis inflata Stål, 1858: 64; Walker, 1873: 181.

Sphaerocysta inflata Stål, 1873: 128; Drake, 1930: 1; 1935: 11; 1936: 699; Drake & Hambleton, 1934; 438; Costa Lima, 1936: 130; Drake & Poor, 1937: 305, plate 36, figure 5; 1939: 96; Monte, 1938: 131; Monte, 1939: 78; Kormilev, 1955: 67; Drake & Davis, 1960: 69; Drake & Ruhoff, 1965: 352; Montemayor & Coscarón, 2005: 42; Guilbert & Montemayor, 2010: 560; Guidoti & Montemayor (in prep).

Material examined. No data: 1 sex undefined and 2 #f (MLPA); BRAZIL, **Goiás**: #f, Rib. Vãozinho, 12.ii.1962, J. Bechyné (MZSP); **Minas Gerais**: #m, #f, Belo Horizonte, no date, Oscar Monte (MNRJ); 3 undefined sex pinned together, same locality, no date, no collector (USNM/Inflata_060); #f, Viçosa, no date, E.J. Hambleton (MNRJ); 2 #f, same locality and collector, 13.iv.1933, "C. J. Drake Coll. 1956", "15" (USNM/Inflata_053; 054); #m, #f, same data, "J. C. Lutz Collection, 1961" (USNM/Inflata _059; 061); 2 #f, same locality and collector, 29.iv.1934 (USNM/Inflata_051; 052); 9 #m, 11 #f, same locality, 13.x-1.xi.1985, TJ. Henry and P. S. Fiuza F. (USNM/Inflata_006−009; 019−022; 024−034); 11 #m, #f, same county, Córrego do Paraíso, Mata da Prefeitura, 10.iii.1993, T.J. Henry (USNM/Inflata_001−005; 012−017; 0023); #m, #f, Pouso Alegre, ix.1962, F.S. Pereira (MZSP); **Rio de Janeiro**: #m, Rio de Janeiro, Represa Rio Grande, viii.1972, F.M. Oliveira (AMNH); **Paraná**: #f, Londrina, iii.1975, M. Alvarenga (AMNH); #f, Jundiaí do Sul, Fazenda Monte Verde, 1.ix.1986, Levantamento Entomológico PROFAUPAR (DZUP); 2 #f, same locality and collector, respectively, 22.ix.1986, 6.x.1986 (DZUP); **Santa Catarina**: 2 #m, 2 #f, Nova Teutônia, 5.xii.1952, Fritz Plaumann, "C.J. Drake Coll. 1956" (USNM/Inflata_035; 036; 046; 048); #m, 2 #f, same locality and collector, 24.xii.1952, "C.J. Drake Coll. 1956" (USNM/Inflata_037; 045; 047); #f, same locality and collector, 5.ii.1953, "J.C. Lutz Collection, 1961" (USNM/Inflata_062); #m, same locality and colletor, 27º11' B, 52º23' L, 14.iv.1938 (MNRJ); #m, same locality and collector, 8.x.194?,"J.C. Lutz Collection, 1961" (USNM/Inflata_058); 8 #m, #f, same locality and collector, 27º 11' B, 52º 23' L, v.1975 (DZUP); **Rio Grande do Sul**: #f, no data, “C. J. Drake Coll. 1956”(USNM/Inflata_055); sex undefined, M.R. [Marcelino Ramos], 8.ix.1939, no collector (MCNZ/ 6499); BOLIVIA, **[Beni]**: #m, Boa Vista, no date, A. Proceu, “Kormilev Collection” (USNM/ Inflata_040); PARAGUAY, **Alto Parana**: 2 #m, SE Naranjal, viii.1988, no collector (USNM/Inflata_010; 011; **La Cordillera**: 2 #m, S[an] Bernardino, no date, Fiebrig, “C.J. Drake Coll. 1956” (USNM/Inflata _044; 057); **Am** [**Amambay**?]: #f, Chaco, Rio Negro, no date, Reimoser, “C.J. Drake Coll. 1956” (USNM/Inflata_056); ARGENTINA, **Jujuy**: #m, Calilegua, 23°44'464" S, 64°51'186" W, 800[m?], 04.vi.2007, Montemayor (MLPA); **Salta**: #f, Campichuelo-Porcelana rd., 22°56' S, 64°04' W, 500m, 17.xi.1995, L. Herman (AMNH); #m, Urundel, 1953, R. Lucero, “C.J. Drake Coll. 1956” (USNM/Inflata_041); 2 #m, same locality, 23°26'638" S, 64°30'638" W, 07.vi.2007, Montemayor (MLPA); #f, Positos, ix.1957, A. Martinez, “Kormilev Collection” (USNM/Inflata_049); **Chaco**: #m, no locality, ii.1936, M.J. Viana (USNM/Inflata_043); 1 sex undefined, 2 #m, 1 #f, La Escondida, 28.x.1936, Denier (MLPA); #m, Puerto Tirol, 10.x.1956, no collector (USNM/Inflata_042); sex undefined, Resistencia, 14.xi.1938, Denier (MLPA); sex undefined, Fontana, 14.iii.1936, Denier (MLPA); 2 sex undefined, **Misiones**, Loreto, no date, Dr. A.A. Oglobin (MLPA); sex undefined, Est. Ext Loreto, no date, Dr. A.A. Oglobin (MLPA).

Description. General color hyaline, light brownish hood, pronotal disc and cyst, and some hemelytra parts (Fig. 7b). Scape two times the length of pedicel; subequal in color.

Basiflagellomere three times the disitiflagellomere length; the last with a apex darker. Head with three spines (frontal pair and medial); bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of mesosternum; apex darker. Hood spherical, central vein darker; areolas uniform (Fig. 8b), conspicuously bigger than the pronotal disc punctures. Median carinae areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, as high as the hood; three subequal cels right before cyst. Lateral carina slightly concave, areolated. Paranota areolated, posteriorly projected; median and posterior region subequal in width and wider than anterior region (Fig. 6d); two rows of areolas; the outer row's areolas at least three times the size of the inner row's areolas. Mesosternal laminae widening, concave; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra hyaline, presenting two stains: one at the hemelytra cyst, excluding the very top of the cyst and other on the posterior region of sutural area; costal area lateral veins also darker. Outer margin folded anteriorly; then uniformly widening posteriorly; widest at sutural region. Costal area irregularly biseriated (Fig. 4b); inner row's areolas subrounded at the anterior region and subrectangular at the posterior region, smaller than the ones of the outer row, these subrectangular; subcostal area with two rows of areolas, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, located at the same position than the widest part of the subcostal area, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, similar in size with those of the distal part of the discoidal area; larger subsquared cells posteriorly, almost half the length than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.198 (0.180 – 0.217); pedicel length: 0.101 (0.085 – 0.110); bastiflagellomere length: 1.115 (0.989 – 1.238); distiflagellomere length: 0.335 (0.308 – 0.377); discoidal area length: 0.952 (0.821 – 1.046); total body length: 2.902 (2.600 – 3.457); total body width: 1.476 (1.348 – 1.621); hood height: 0.395 (0.308 – 0.442); posterior pronotal cyst height: 0.300 (0.229 – 0.354).

Distribution (Fig. 2a). ARGENTINA (Chaco; Jujuy; Missiones; Salta); BOLIVIA (Beni); BRAZIL (Goiás – new record; Mato Grosso; Minas Gerais; Paraná – new record; Rio de Janeiro; Rio Grande do Sul – new record; Santa Catarina); PARAGUAI (Alto Paraná; La Cordillera).

Comments. See *S. biseriata* “comments”.

SPHAEROCYSTA NOSELLA **DRAKE & HAMBLETON, 1945 (Figs. 7c, 8c)**

Sphaerocysta nosella Drake & Hambleton, 1945: 358; Drake & Ruhoff, 1965: 352;

Guidoti & Montemayor (in prep).

Material examined. Holotype: ECUADOR, **Los Rios**: #m, Vinces, 14.x.1944, E.J. Hambleton (USNM/Nosella_001). Paratype: same data as holotype, 5#m, 3 #f (USNM/Nosella_002−008). Additional Material: BRAZIL, **Pará**: #m, Belém, 8.ii.1939, A.M. Nadler (AMNH)

Description. General color hyaline, dark brown hood, pronotal disc and cyst, and some hemelytra parts (Fig. 7c). Scape subequal to pedicel in length and color. Basiflagellomere about three times the disitiflagellomere length; the last with a apex darker. Head with three spines (frontal pair and medial); bucculae closed in front, two rows of areolas. Postero-orbital plate present, lighter than the head. Rostrum slightly surpassing the middle of the mesosternum; apex darker. Hood spherical, triangle-shaped anteriorly; areolas unequal in size and shape, smaller ones in the anterior region, two larger ones posteriorly located (Fig. 8c). Median carinae areolated also on pronotal disc, areolas not fully developed; ending in a large cyst on the posterior projection of pronotum, lower than hood; one cell right before cyst. Lateral carina slightly concave, areolated. Paranota areolated, posteriorly projected; width uniform; one row of areolas. Mesosternal laminae widening, almost straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra hyaline; hemelytra cyst brown. Outer margin folded anteriorly; then uniformly widening posteriorly; widest at sutural region. Costal area mostly uniseriated or irregularly biseriated; inner row's areolas subrectangular and as large as the outer row's areolas at the posterior region; subcostal area with two rows of areolas, one anteriorly; discoidal area with three rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas about twice as large as the ones of the subcostal area; radius-media curved posteriorly; sutural area with slightly smaller cells anteriorly, similar in size with those of the distal part of the discoidal area; larger subsquared cells posteriorly, these slightly smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.121 (0.103 – 0.123); pedicel length: 0.063 (0.062 – 0.077); bastiflagellomere length: 0.793 (0.762 – 0.819); distiflagellomere length: 0.230 (0.213 – 0.249); discoidal area length: 0.774 (0.700 – 0.827); total body length: 2.356 (2.333 – 3.395); total body width: 1.102 (1.043 – 1.138); hood height: 0.311 (0.308 – 0.327); posterior pronotal cyst height: 0.244 (0.226 – 0.267).

Distribution (Fig. 2b). BRAZIL (Pará) – new record; ECUADOR (Los Rios).

Comments. *Sphaerocysta nosella* is the only species of this genus with a single row of cells in the paranota. It is also the smallest member of *Sphaerocysta*. The general shape resembles *S. inflata*, *S. biseriata*, *S. fumosa* and *S. ruthae* n. sp.

SPHAEROCYSTA PARIS DRAKE, 1939 (Figs. 6e, 7d)

Sphaerocysta paris Drake, 1939: 529; Silva, 1956: 48; Drake & Ruhoff, 1961: 145; Drake & Ruhoff, 1965: 352; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, **Bahia**: #f, no data, "C.J. Drake Coll. 1956", [blue label] "return Holotype to Hung. Mus." (USNM/Paris_type). Allotype: BRAZIL, **Bahia**: #m, Iguassú, no date, Roman, "Sv. Amaz. Exp. Roman", "Syn. paris", "allotype S. romani", "5 juli", "C.J. Drake Coll. 1956"(USNM/Paris_002). Paratype: sex undefined, same data as holotype, "paratype S. paris by C.J. Drake"[red label], "C.J. Drake Coll. 1956"(USNM/Paris_003); sex undefined, same data as allotype (USNM/Paris_001).

Description. General color light brownish, darker on hood, pronotal disc and on top of the hemelytra cyst (Fig. 7d). Scape slightly longer than pedicel; same color. Basiflagellomere about four times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas. Postero-orbital plate present, lighter than the head. Rostrum slightly surpassing the middle of the mesosternum; apex darker. Hood spherical, central vein slightly darker; areolas uniform, conspicuously bigger than the pronotal disc punctures. Median carinae areolated also on pronotal disc, areolas not full-developed; ending in a small cyst on the posterior projection of pronotum, conspicuously lower than hood; one full-developed small cell right before cyst. Lateral carina straight, areolated. Paranota areolated, median-constricted (Fig. 6e); anterior and posterior region subequal in width with one row full-developed areolas; median region with not full-developed areolas; median and posterior region elevated; anterior region not elevated. Mesosternal laminae widening, straight; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra light brownish; hemelytra cyst dark brown at the very top. Widening anteriorly, widest right after discoidal area. Costal area mostly uniseriated, biseriated posteriorly; inner row's and outer row's of areolas subequal in size and subrectangular; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, slightly bigger than the those of the distal part of the discoidal area; larger subsquared cells posteriorly, subequal in length to the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.169 (0.164 – 0.185); pedicel length: 0.090 (0.085 – 0.092); bastiflagellomere length: 1.117 (1.086 – 1.162); distiflagellomere length: 0.272

(0.266 – 0.284); discoidal area length: 0.957 (0.927 – 0.987); total body length: 3.350 (3.298 – 3.402); total body width: 1.258 (1.222 – 1.309); hood height: 0.375 (0.365 – 0.404); posterior pronotal cyst height: 0.144 (0.123 – 0.164).

Distribution (Fig. 2a). BRAZIL (Bahia).

Comments. This species resembles *S. egregia* in general shape. *Sphaerocysta paris* can be separated from this aforementioned species by the paranota, equally developed in the anterior and posterior region, medially constricted (Fig. 6e) and by the posterior pronotal cyst, present.

SPHAEROCYSTA PROPRIA **DRAKE & POOR, 1939 (Figs. 5b, 7e, 8d)**

Sphaerocysta propria Drake & Poor, 1939: 31; Drake & Ruhoff, 1965: 352; Guidoti & Montemayor (in prep).

Sphaerocysta maculata Monte, 1942: 95, figure 2; Drake & Ruhoff, 1965: 352; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, **Rio Grande do Sul**: sex undefined, no locality, no date, Stieglmayr (USNM/Propria_type). Paratype: BRAZIL, **São Paulo**: #m, Chavantes, 10.v.1941, Oscar Monte (MNRJ). Additional material: BRAZIL, **São Paulo**: 5 #m, #f, Ilha dos Búzios, 16.x-4.xi.1963, Exp. Dep. Zool. (MZSP); #f, L. Pinto (?), 24.vi.1942, Oscar Monte (MNRJ); **Paraná**: #m, S.[ão] José [dos] Pinhais, Serra do Mar, 18.viii.1986, Levantamento Entomológico PROFAUPAR (DZUP); **Rio Grande do Sul**: #m, Maquiné, Est. Exp. Fepagro, i,2006, no collector (MCNZ/179607); #f, same locality, iv.2006 (MCNZ/179774); #m, same locality, vii.2006 (MCNZ/179771); #f, Triunfo, Parque Braskem, 10.i.2012, J. Krticka (MCNZ/181951); 2 #m, Porto Alegre, Afloramento próximo – ETE Ipanema, 17.ix.2003, R. Ott, A. Barcellos (MCNZ/54395; 54397).

Description. General color light brownish, darker on hood, pronotal disc, top of the hemelytra cyst and posterior region of hemelytra (Fig. 7e). Scape twice as longer than pedicel; same color. Basiflagellomere about four times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of the mesosternum; apex darker. Hood spherical, tapering anteriorly; central vein darker; areolas uniform, subequal in size to the pronotal disc punctures, except two postero-dorsal and two postero-ventral conspicuously larger cells; postero-dorsal cells close to the central vein (Fig. 8d). Median carinae areolated also on pronotal disc, ending in a small cyst on the posterior projection of pronotum, conspicuously lower than hood; one full-developed small cell right before cyst. Lateral carina anteriorly thin then strongly thick, sinous, areolated; higher at the pronotal disc. Paranota areolated, uniseriated; anterior region less elevated than the median and posterior regions. Mesosternal laminae widening, slightly concave; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra light brownish; hemelytra cyst slightly darker at the higher part. Widening anteriorly, widest right after discoidal area. Costal area uniseriated in the anterior region (Fig. 5b); subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst; discoidal area with four rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas subequal in size to the ones of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, subequal in size to those of the distal part of the discoidal area; larger subsquared cells posteriorly, these smaller than the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.172 (0.154 – 0.185); pedicel length: 0.089 (0.077 – 0.092); bastiflagellomere length: 1.074 (1.015 – 1.154); distiflagellomere length: 0.265 (0.231 – 0.308); discoidal area length: 0.834 (0.785 – 0.846); total body length: 2.547 (2.500 – 2.600); total body width: 1.062 (1.015 – 1.092); hood height: 0.329 (0.308 – 0.369); posterior pronotal cyst height: 0.111 (0.092 – 0.138).

Distribution (Fig. 2b). BRAZIL (Paraná – new record; Rio Grande do Sul; São Paulo – new record).

Comments. See *S. brasiliensis* “comments”.

SPHAEROCYSTA RUTHAE GUIDOTI NEW SPECIES (Figs. 6f, 8e, 10a, 10b)

Material examined. Holotype: BRAZIL, **Minas Gerais**: #f, Santa Vitória, ii.1970, F.M. Oliveira (AMNH).

Description. General color hyaline, light brownish hood, pronotal disc and cyst, and some hemelytra parts (Fig. 10a). Scape two times the length of pedicel; subequal in color. Basiflagellomere about four times the disitiflagellomere length; the last uniform in color. Head with three spines (frontal pair and medial); bucculae open in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the anterior region of metasternum; apex darker. Hood oval (Fig. 8e), central vein darker; areolas uniform, conspicuously bigger than the pronotal disc punctures. Median carinae areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, slightly lower than hood; two unequal cels right before cyst. Lateral carina slightly concave, areolated and divergent. Paranota areolated, posteriorly projected; median and posterior region subequal in width and wider than anterior region (Fig. 6f); two rows of areolas; the outer row's areolas four to five times the size of the inner row's areolas. Mesosternal laminae widening, almost straight;

metasternal laminae narrowing, concave (Fig. 10b). Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra hyaline, presenting one stain at the hemelytra cyst, excluding the very top of the cyst; costal area lateral veins also darker. Outer margin folded anteriorly; then uniformly widening posteriorly, slightly constricted at the sutural region; widest after this constriction. Costal area biseriated; areolas subrectangular, inner row's areolas smaller than the ones of the outer row; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst; discoidal area with three rows of areolas in the widest part, located at the same position than the widest part of the subcostal area, these areolas subequal in size to those of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, similar in size with those of the distal part of the discoidal area; larger subsquared cells posteriorly, subequal in length to the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.185; pedicel length: 0.092; bastiflagellomere length: 1.338; distiflagellomere length: 0.385; discoidal area length: 1.077; total body length: 3.500; hood height: 0.554; posterior pronotal cyst height: 0.462.

Distribution (Fig. 2a). BRAZIL (Minas Gerais).

Etymology. This species was named after Ruth Salas, scientific assistant of the AMNH, who not only gently helped in processing the loan of several specimens which enable this study to be concluded, as was also very helpful in the first author's visit to AMNH.

Comments. This is the only species of the genus with an oval hood instead of a spherical one (Figs. 6f, 8e). The length of this structure is subequal to the width. The general shape of this species resembles the one of the *S. inflata* and *S. biseriata*.

SPHAEROCYSTA STALI **DRAKE, 1928 (Figs. 7f, 9b)**

Sphaerocysta globifera (not Stal): Champion, 1898: plate 2, figures 11, 11a.

Sphaerocysta stali Drake, 1928: 43; Drake & Bondar, 1932: 87; Silva, 1956: 51; Drake & Ruhoff, 1965: 352; Guidoti & Montemayor (in prep).

Material examined. Holotype: BRAZIL, **Rio de Janeiro**: sex undefined, no data (USNM/Stali_type).

Additional material: BRAZIL, **Bahia**: #m, no data (MNRJ); #m, no locality, no date, Greg. Bondar, "C.J. Drake Coll. 1956"; sex undefined, 1931, Greg. Bondar (USNM/Stali_001; 002); sex undefined, same data,"no. 1144-1931" (USNM/Stali_006); 3 specimens, sex undefined, no data, "C.J. Drake Coll. 1956" (USNM/Stali_003–005).

Description. General color light brownish, darker on hood, pronotal disc, pronotal posterior cyst, top of the hemelytra cyst (Fig. 7f). Scape twice as longer than pedicel; same color. Basiflagellomere about three and a half times the disitiflagellomere length. Head with only the frontal pair of cephalic spines; bucculae closed in front, two rows of areolas, three at the widest part. Postero-orbital plate present, lighter than the head. Rostrum reaching the posterior region of the mesosternum; apex darker. Hood spherical, tapering anteriorly; areolas uniform, subequal in size to the pronotal disc punctures, except two postero-dorsal and two postero-ventral conspicuously larger cells; postero-dorsal cells away from the central vein. Median carinae areolated also on pronotal disc, ending in a large cyst on the posterior projection of pronotum, slightly higher than the hood; two largely unequal cells right before cyst (Fig. 9b). Lateral carina anteriorly thin then strongly thick, sinous, areolated; higher at the pronotal disc; areolas full-developed at this region. Paranota areolated, biseriated at the anterior region, uniseriated at the median and posterior region; anterior region wider and less elevated than the median and posterior regions. Mesosternal laminae widening, concave; metasternal laminae narrowing, concave. Legs light yellowish, with few and short hairs; tarsi darker. Hemelytra light brownish; hemelytra cyst slightly darker at the very top. Widening anteriorly, widest at the sutural area. Costal area mostly irregurlaly biseriated; inner row's areolas conspicuously smaller than the ones of the outer row; subcostal area with two rows of areolas anteriorly, three in the widest part at the higher region of hemelytra cyst, the areolas of the row next to costal area smaller than the others; discoidal area with three rows of areolas in the widest part, at the highest part of the hemelytra cyst, these areolas larger than the bigger ones of the subcostal area; radius-media curved posteriorly; sutural area with smaller cells anteriorly, subequal in size to the ones of the distal part of the discoidal area; larger subsquared cells posteriorly, these half the size of the posterior ones of the costal area; outer row bears large, squared cells. Abdomen brown, with few and short hairs, widest part between the fourth and fifth segment.

Measurements. Scape length: 0.211 (0.192 – 0.256); pedicel length: 0.102 (0.092 – 0.120); bastiflagellomere length: 1.303 (1.182 – 1.403); distiflagellomere length: 0.367 (0.351 – 0.397); discoidal area length: 1.038 (0.927 – 1.107); total body length: 3.476 (3.245 – 3.839); total body width: 1.295 (1.193 – 1.338); hood height: 0.378 (0.350 – 0.402); posterior pronotal cyst height: 0.437 (0.414 – 0.470).

Distribution (Fig. 2b). BRAZIL (Bahia; Rio de Janeiro).

Comments. See *S. globifera* “comments”.

Discussion

The present analysis intended to test the monophyly of the genus *Sphaerocysta*. It was corroborated, supported by two homoplastic synapomorphies, including the new species here described. The new species, *S. ruthae* n. sp. shares with *Dicysta* the shape of the hood, oval. It was placed at the base of the clade of the genus, as sister-group of all others species of *Sphaerocysta*. The three clades better supported within *Sphaerocysta* were *S. angulata* + *S. costai*, *S. brasiliensis* + *S. propria* and *S. globifera* + *S. stali*. These groups are compound by very morphologically similar species, and its relationships as sister-groups were not unexpected. *Sphaerocysta brasiliensis*, *S. propria*, *S. globifera* and *S. stali* are the only species with conspicuously larger areolas dorsally and ventrally on the hood, and the relationship among them confirmed the phylogenetic proximity between these taxa. The clade composed by *S. angulate* + *S. costai*, *S. brasiliensis* + *S. propria* and *S. globifera* + *S. stali* comprises all species with narrow paranota, lack of the medial cephalic spine and absence of hemelytral fold on the anterior region.

The sister-group of the genus was *Dicysta*. *Dicysta smithi*, considered in a Monte's handwritten label as a *Sphaerocysta* species, was the sister-group of all the other six *Dicysta* included in this analysis. Therefore, Monte's hypothesis regarding the taxonomic status of *D. smithi* was refuted in our results. Besides only seven species of this genus were included, our results corroborated with the hypothesis of monophyly of this taxon. This genus comprises species from South America, Australia and New Caledonia (Drake & Ruhoff, 1965; Guilbert, 1997). A more comprehensive and specific analysis together with a taxonomic review of this genus should be conducted in order to a better understanding of its systematics. *Galeatus spinifrons*, a Paleartic species, was considered sister-group of the clade *Dicysta* + *Sphaerocysta*, besides the morphology remarkable different between *G. spinifrons* and these two genera. This species is a senior synonym of *S. peckami*. Due the aforementioned morphological differences, we believe that the early placement of this taxon in *Sphaerocysta* was a taxonomic mistake. Nevertheless, this phylogenetic relationship recovered in our analysis was supported by one synapomorphy (lateral carina with areolas only at the pronotal disc) and four HS.

Sphaerocysta maculata is proposed here as a junior synonym of *S. propria*. The former was described by Monte during the period of his disagreement with the other prolific author in the Neotropical tingids, Carl Drake. It is clear that this issue affected the taxonomy of several genera (Guidoti, in press). In addition, *S. brasiliensis* differs from *S. propria* by only the number of areolas at the anterior region of the costal area. This character proved to be highly polymorphic in species where more material were available. Since only a few specimens of *S. brasiliensis* were studied, we believe that more material is needed to allow a taxonomic decision regarding the status of this species. However, specimens of *S. brasiliensis* were found in the Drake's collection (USNM), suggesting that this author had access to this material despite his issues with Monte. *Sphaerocysta stali* also has just few specimens collected so far. This species is more closely related to *S. globifera*, the most represented species in the scientific collections consulted. The difference between these species are mostly related to the posterior pronotal cyst, and this characters showed as highly polymorphic in *S. globifera*. More specimens of *S. stali* should be studied to access its taxonomic status. Therefore, both *S. stali* and *S. brasiliensis* are here considered as valid due the lack of material.

Although the monophyly of the genus *Sphaerocysta* was corroborated, the genus was not supported by any unambiguous synapomorphy. In this analysis, we proposed new morphological characters for the tingid literature, addressing a different approach in the task of define the primary homology in such complex characters as the paranota and hemelytra. The detailed character construction approach may had led to such homoplasy levels. However, we believe that this strategy is most suitable in order to keep all the information present in such structures. New data should be added in further phylogenetic analyses, such as molecular and immature characters, in order to strengthen the hypothesy of monophyly of the genus.

Acknowledgments

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References

Ashmead WH. 1887. Hemipterological contributions (No. 1). *Entomologica Americana* 3: 155-156.

Cassis G, Symonds C. 2011. Systematics, biogeography and host plant associations of the lace bug genus *Lasiacantha* Stål in Australia (Insecta: Hemiptera: Heteroptera: Tingidae). *Zootaxa* 2818: 1-63.

Champion GC. 1897. Rhynchota. *Biologia Centrali-Americana* 2: 1-32.

Curtis J. 1833. Characters of some undescribed genera and species, indicated in the "Guide to an arrangement of British insects.*Entomological Magazine*. 1: 186-199.

Drake CJ, Hambleton EJ. 1935. New Brazilian Tingitidae (Hemiptera). Part II. *Archivos do Instituto Biológico de São Paulo* 6(16): 141-154.

Drake CJ, Hambleton EJ. 1939. Twenty new Brazilian Tingitidae (Hemiptera). Part V. *Archivos do Instituto Biológico de São Paulo* 10(9): 153-163.

Drake CJ, Hambleton EJ. 1945. Concerning Neotropical Tingitidae (Hemiptera). *Journal of the Washington Academy of Sciences* 35(11): 356-367.

Drake CJ, Poor ME. 1939. Seven New American Tingitidae (Hemiptera). *Bulletin of the Brooklyn Entomological Society* 34(1): 31-35.

Drake CJ, Ruhoff FA. 1965. Lacebugs of the World: A Catalog (Hemiptera: Tingidae).

United States National Museum Bulletin 243: 1-653.

Drake CJ. 1922a. The genus Dicysta Champion (Hemiptera). *Annals of the Carnegie Museum* 13(3-4) 269-273.

Drake CJ. 1922b. Neotropical Tingitidae with descriptions of three new genera and thirty-two new species and varieties (Hemiptera). *Memoirs of the Carnegie Museum* 9(2) 351-378.

Drake CJ. 1928a. New and Little Known Neotropical Tingitidae. *Iowa State College Journal of Science* 3(1): 41-56.

Drake CJ. 1928b. Concerning some Tingitidae from Argentina with descriptions of five new species. *Physis (Revista de la Sociedad Argentina de Ciencias Naturales)* 9: 72-76.

Drake CJ. 1929. Some Tingitoidea from Central and South America. *Bulletin of the Brooklyn Entomological Society* 24(1): 35-37.

Drake CJ. 1939. Seven new South American Tingitidae (Hemiptera). *Revista de Entomologia* 10(3) 525-530.

Drake CJ. 1947. Wissenschaftliche Ergebnisse der schwedischen entomologischen Reisen des Herrn Dr. A. Roman 1914-15 und 1923-24 in Amazonas. 17. Tingididae. *Arkiv for Zoologi* 39B(3) 1-2.

Fallén CF. 1807. *Monographia cimicum*. Sveciae.

Goloboff PA, Farris JS, Nixon KC. 2008. TNT, a free program for phylogenetic analysis. *Cladistics* 24: 774-786

Guidoti M. 2014. Contributions on *Gargaphia* (Heteroptera, Tingidae) systematics: redescriptions of two South American species with considerations on the status of G. inca. *Iheringia* (in press).

Guidoti M, Montemayor S. *Sphaerocysta costai* n. sp. (Heteroptera: Tingidae): new light on the evolutionary trends of Tingidae morphology (in prep).

Guilbert É. 1997. Two new species of *Dicysta* (Hemiptera, Tingidae) from New Caledonia. *Zoosystema* 19(2-3): 515-521.

Guilbert É. 2000. Revision of the genus *Parada* Horváth (Hemiptera: Tingidae) with cladistic analysis. *Proceedings of the Entomological Society of Washington* 102: 816-830.

Guilbert É. 2001. Phylogeny and evolution of exaggerated traits among the Tingidae (Heteroptera, Cimicomorpha). *Zoologica Scripta* 30(4): 313-324.

Guilbert É. 2004. Do larvae evolve the same way as adults in Tingidae (Insecta: Heteroptera)? *Cladistics* 20: 139-150.

Guilbert É. 2012. Phylogeny of Cantacaderinae (Heteroptera: Tingidae) revisited after the description of a new genus and new species from New Caledonia. *European Journal of Entomology* 109: 111-116.

Lis B. 1999. Phylogeny and Classification of Cantacaderini [= Cantacaderidae stat. nov.] (Hemiptera: Tingoidea). *Annales Zoologici* 49(3): 157-196.

Maddison WP, Maddison DR. 2011. Mesquite: a modular system for evolutionary analysis. Version 2.75, http://mesquiteproject.org

Monte O. 1938. Novas tingitideos. *O Campo* February 1938: p. 64.

Monte O. 1940. Tingitideos novos ou pouco conhecidos da fauna Americana. *Arquivos do Instituto Biológico* 11(34) 283-300.

Monte O. 1941. Quatro novos tingitideos da Americo do Sul. *Revista Brasileira Biologia* 1(4) 373-378.

Montemayor SI, Costa LAA. 2009. Systematic revision of *Macrotingis* and phylogenetic analysis of the genera *Macrotingis* and *Ceratotingis* (Heteroptera: Tingidae). *European Journal of Entomology* 106: 631-642.

Nixon KC. 2002. Winclada (BETA) ver. 1.00.08. Retrieved from http://www.cladistics.com/

Oliver GS. 2005. *O papel das Escolas Superiores de Agricultura na institucionalização das ciências agrícolas no Brasil, 1930-1950: práticas acadêmicas, currículos e formação profissional*. Unpublished Ph.D. Thesis, Unicamp.

Schrank F von P. 1801. *Fauna Boica*. Nurnberg.

Schuh RT, Cassis G, Guilbert É. 2006. Description of the First Recent Macropterous Species of Vianaidinae (Heteroptera: Tingidae) with Comments on the Phylogenetic Relationships of the Family within the Cimicomorpha. *Journal of the New York Entomological Society* 114(1-2): 38-53.

Sereno PC. 2007. Logical basis for morphological characters in phylogenetics. *Cladistics* 23: 565-587.

Stål C. 1858. Bidrag Till Rio Janeiro-Traktens Hemipter-Fauna. *Kongl. Svenska Vet. Akad. Handl.* 2(7): 1-75.

Stål C. 1873. Enumeratio Hemipterorum 3. *Kongl. Svenska Vet. Akad. Handl.* 11(2): 1-163.

Fig. 1. Most parsimonious tree (length = 272; consistency index = 0.46; retention index = 0.68). Bremer support values and jackknife GC are indicated above and below branches, respectively.

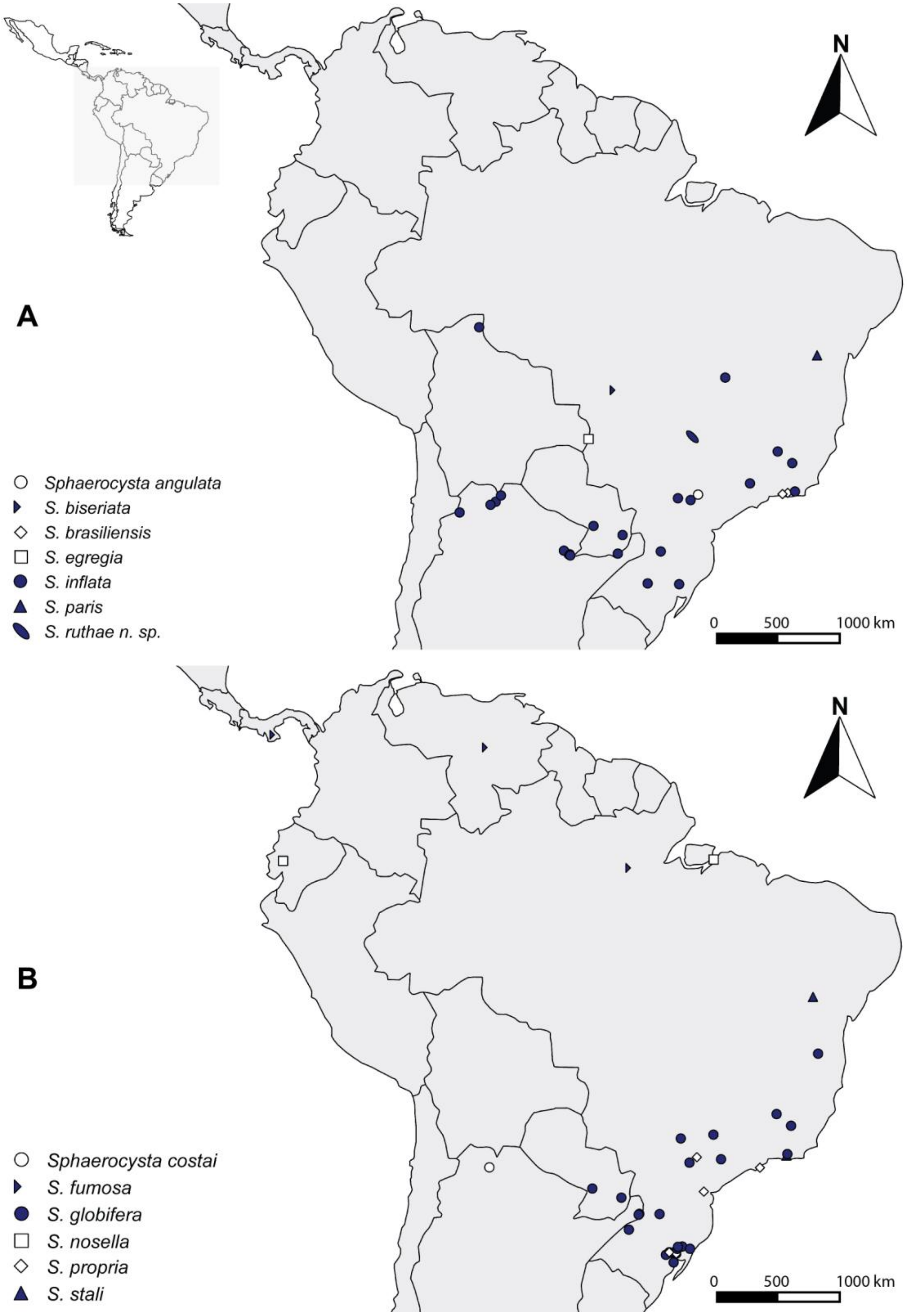

Fig. 2. Distributional data for the species of *Sphaerocysta*.

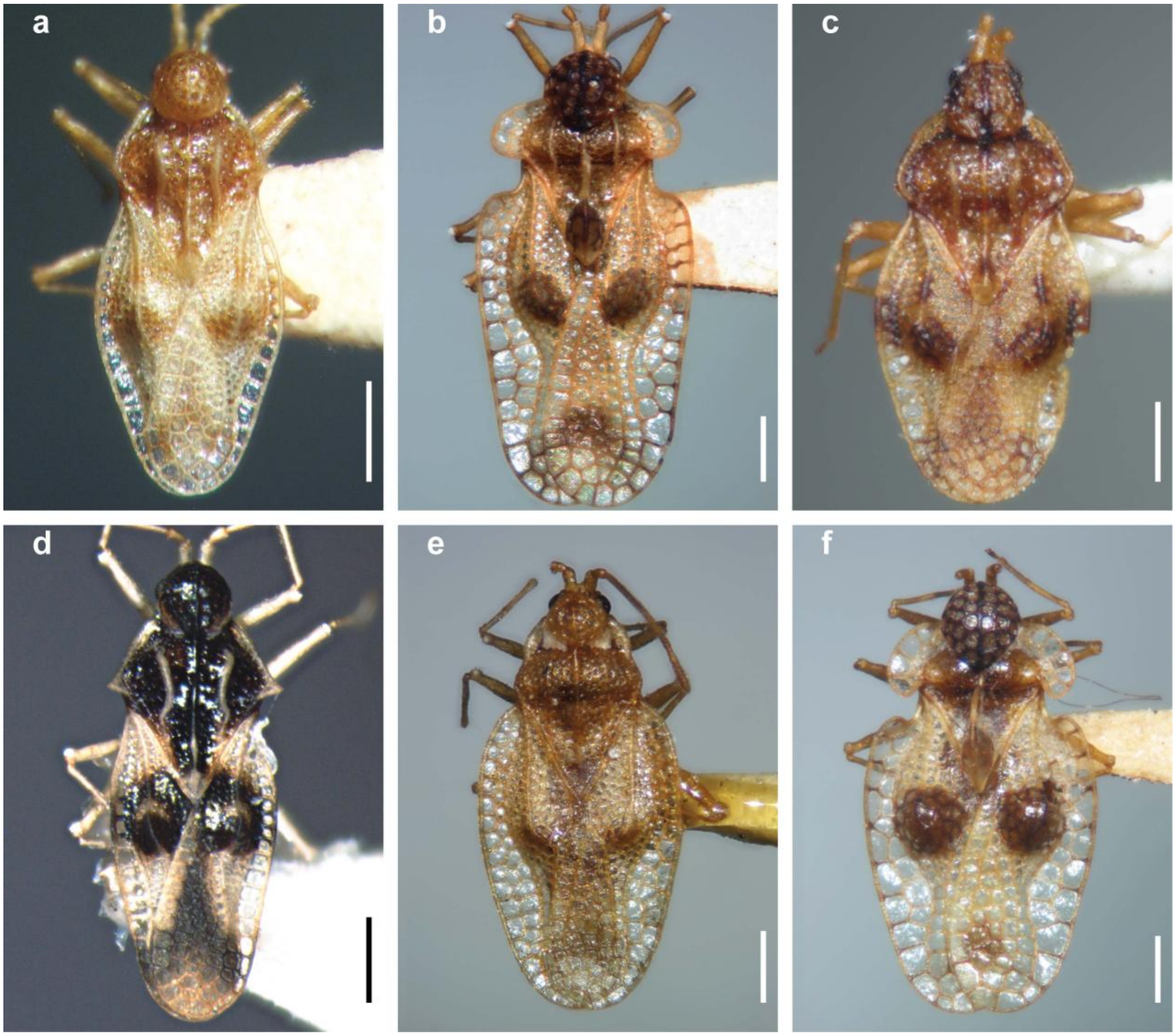

Fig. 3. Habitus dorsal of the species of *Sphaerocysta*. a) *S. angulata*; b) *S. biseriata*; c) *S. brasiliensis*; d) *S. costai*; e) *S. egregia*; f) *S. fumosa*. Scale bar: 0.5 mm.

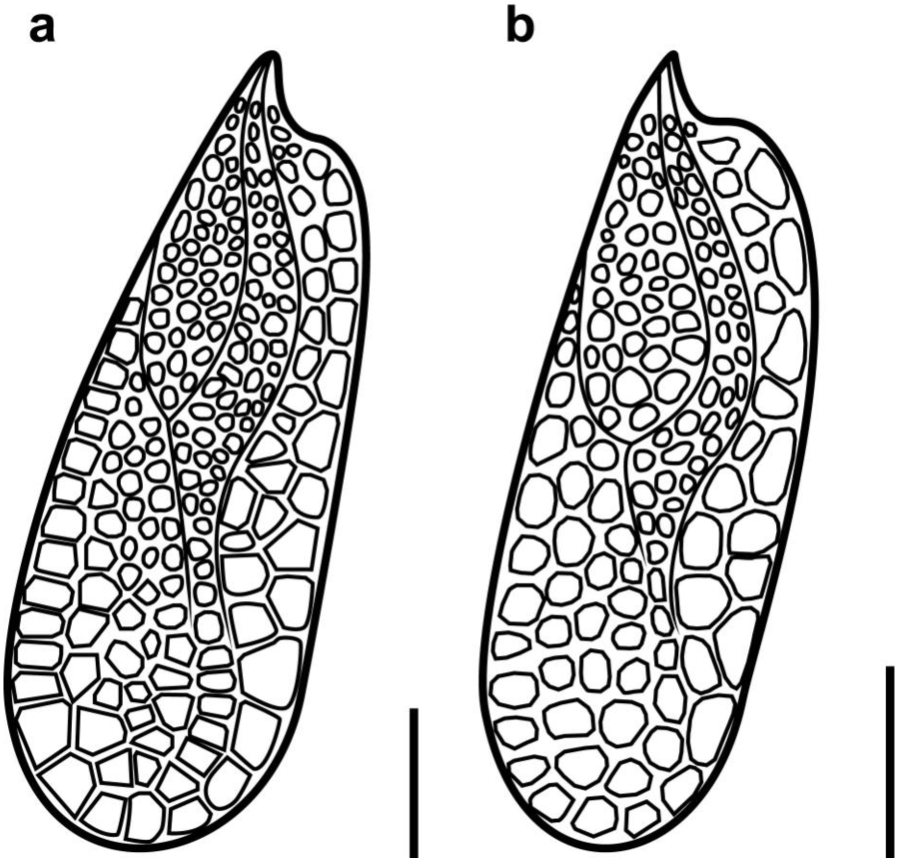

Fig. 4. Hemelytra: a) *S. biseriata*; b) *S. inflata*. Scale bar: 0.5 mm.

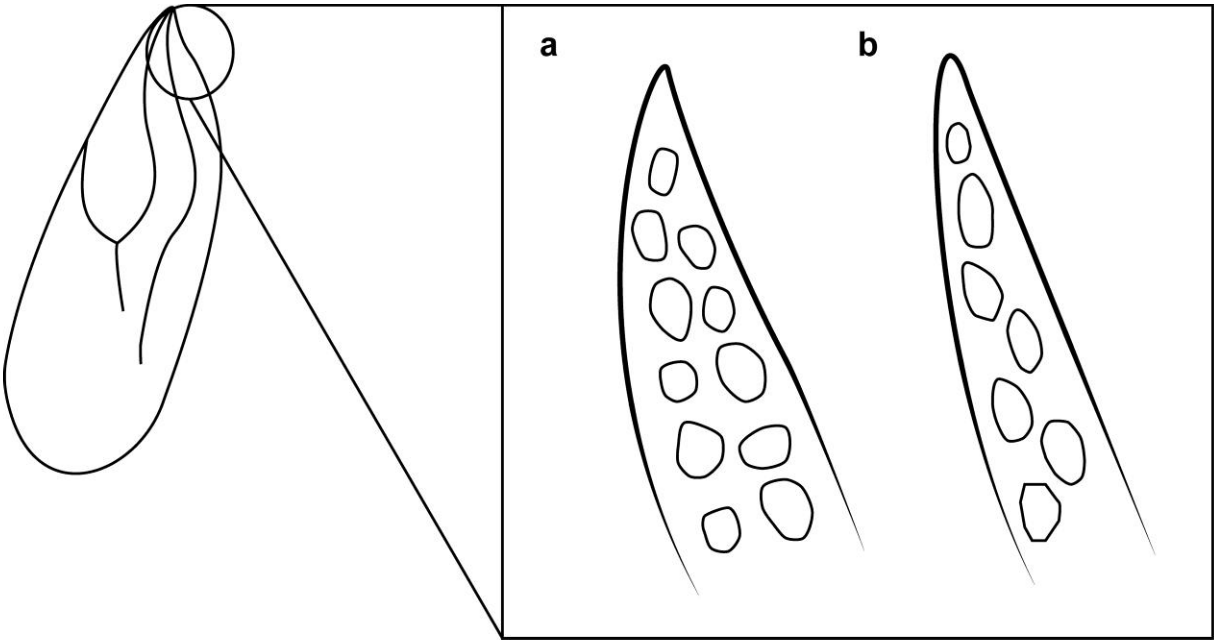

Fig. 5. Anterior region of the hemelytra, costal area: a) *S. brasiliensis*; b) *S. propria*.

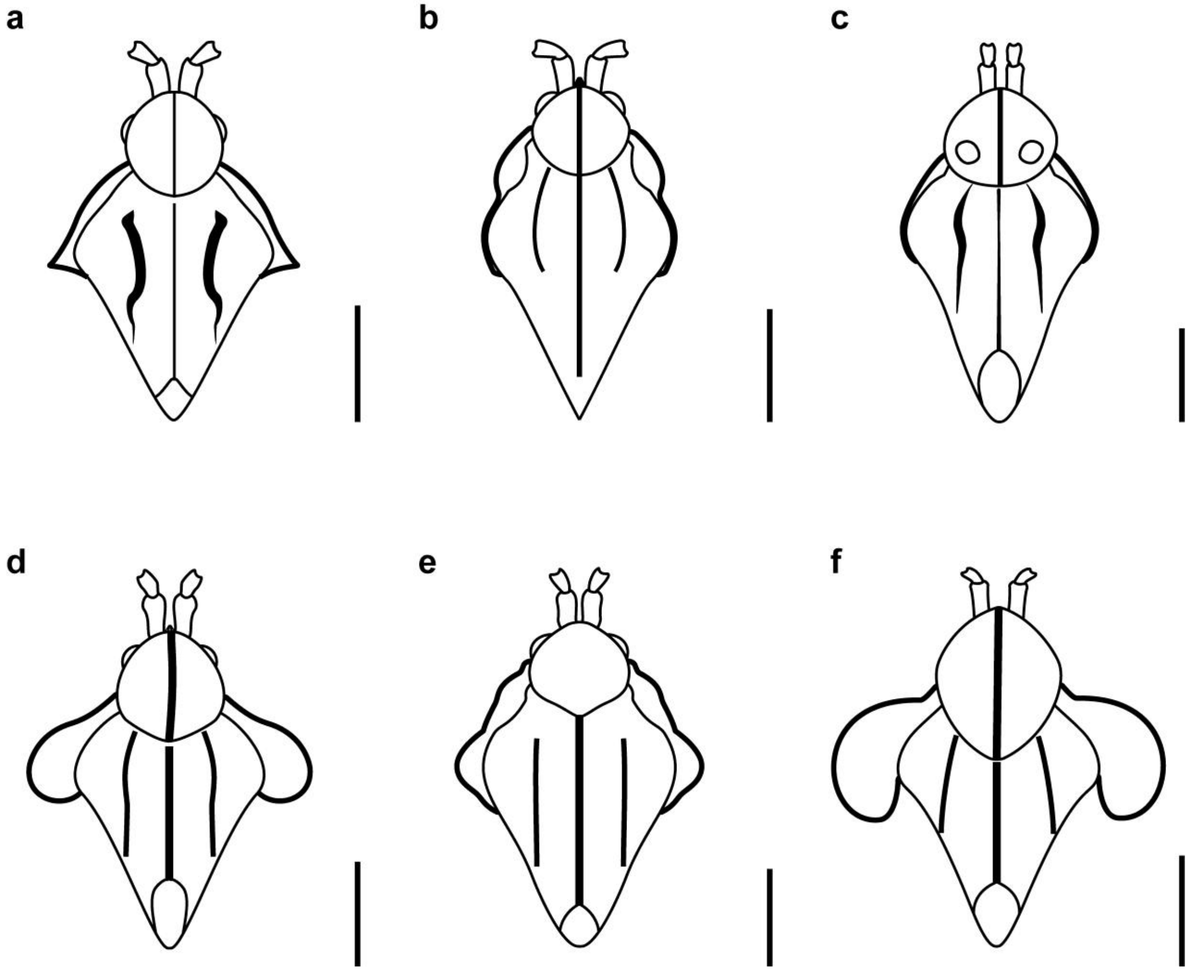

Fig. 6. Pronotum . a) *Sphaerocysta costai*; b) *S. egregia*; c) *S. globifera*; d) *S. inflata*; e) *S. paris*; e) *S. ruthae* n. sp. Scale bar: 0.5 mm.

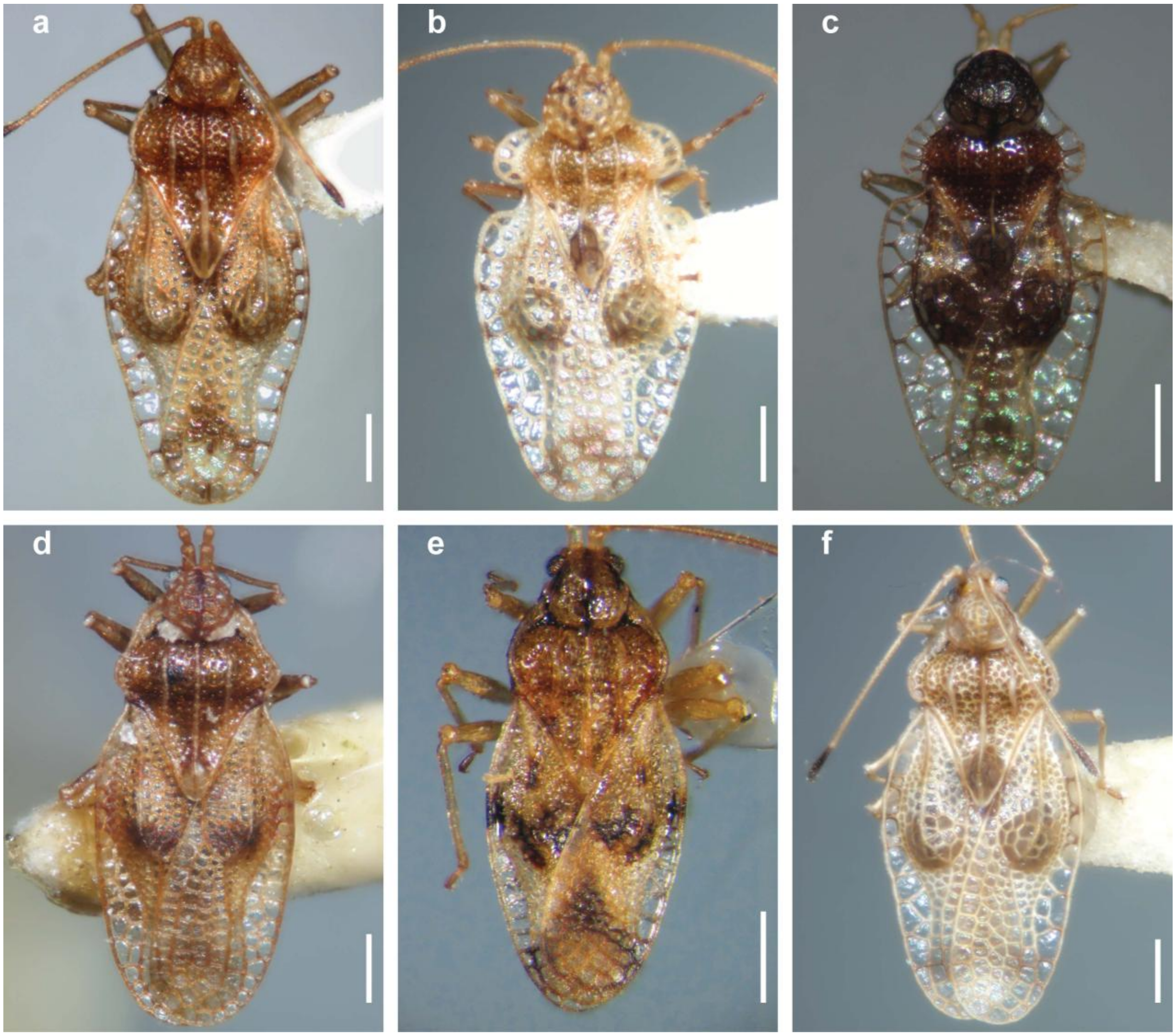

Fig. 7. Habitus dorsal of the species of *Sphaerocysta*. a) *S. globifera*; b) *S. inflata*; c) *S. nosella*; d) *S. paris*; e) *S. propria*; f) S. stali. Scale bar: 0.5 mm.

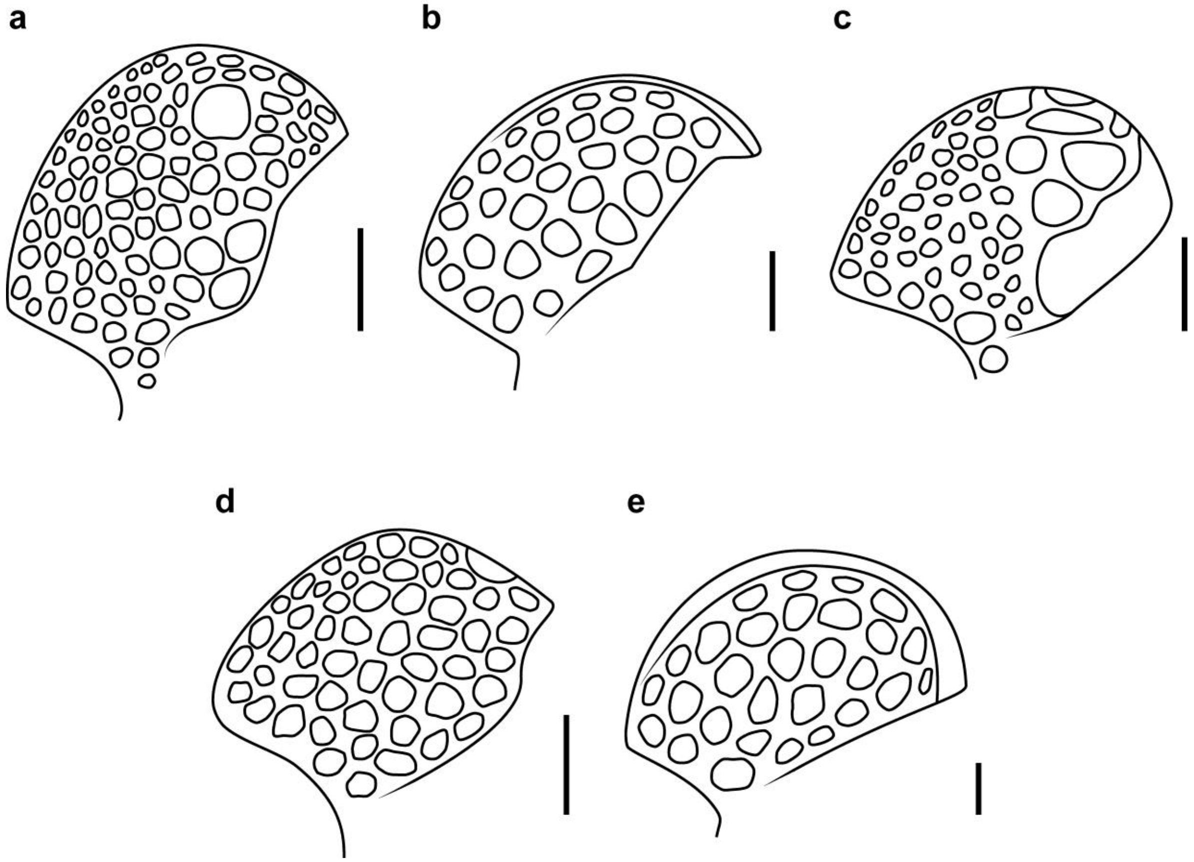

Fig. 8. Hood, lateral view: a) *S. globifera*; b) *S. inflata*; c) *S. nosella*; d) *S. propria*; e) *S. ruthae* n. sp. Scale bar: 0.1 mm.

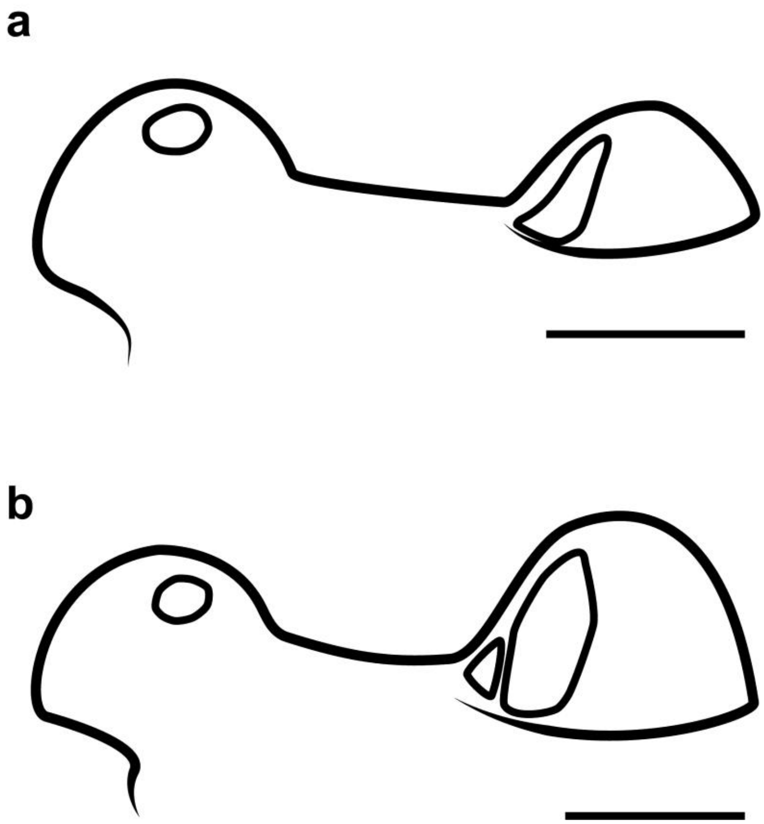

Fig. 9. Lateral view of the hood and posterior pronotal cyst height of two *Sphaerocystia* species. a) *S. globifera*; b) *S. stali*. Scale bar: 0.25 mm.

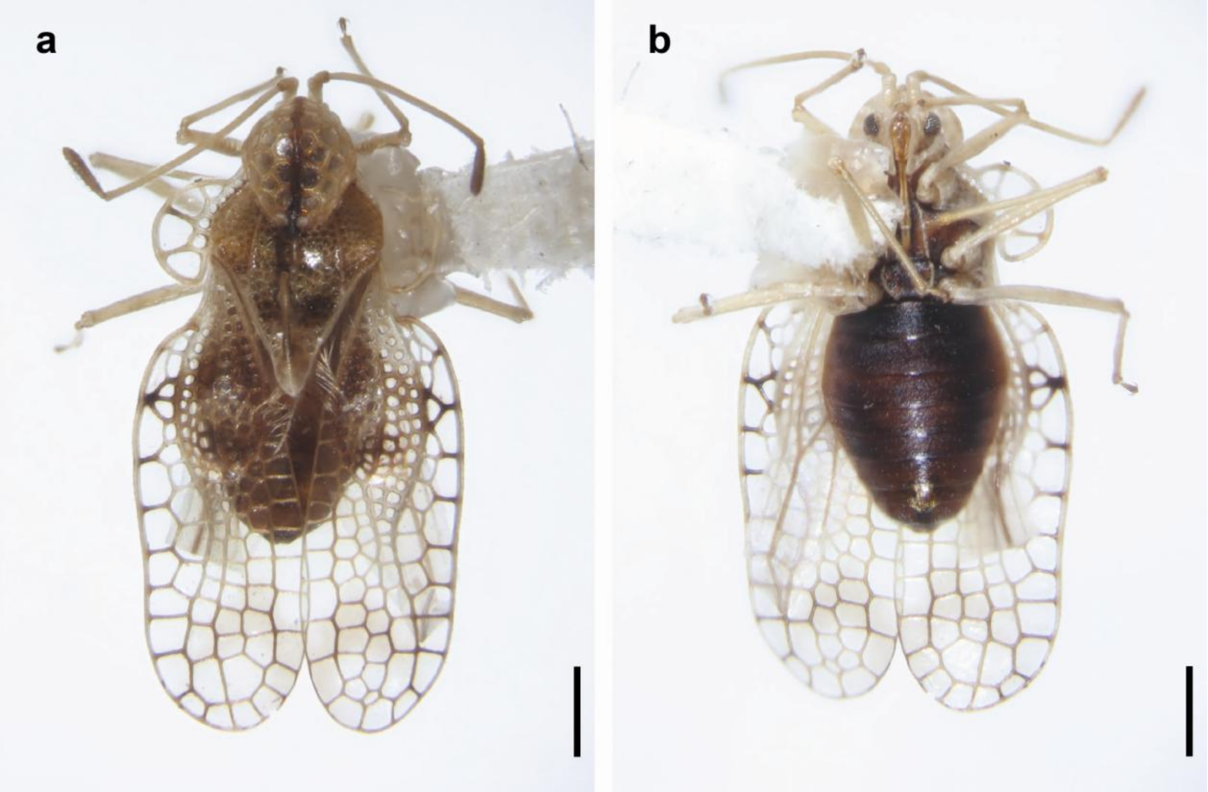

Fig. 10. Habitus of *Sphaerocysta ruthae* n. sp. a) dorsal view; b) ventral view. Scale bar: 0.5 mm.

Table 1. Character matrix with 84 characters for 31 taxa. Symbols: -, inapplicable; ?, missing data; &, multiple states.

											1										2										3										4										5				
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4
Sphaerocysta angulata	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	0	2	0	0	0	-	1	1	0	0	0	1	0	1	0	1	2	1	0	1	1	3	1	2	0	0	0	0	0	0	1	0	3	1
Sphaerocysta biseriata	?	?	?	2	0	0	0	1	1	1	0	0	1	0	0	0	0	1	1	1	2	0	2	1	0	0	-	0	1	0	0	2	1	0	1	0	1	0	1	0	1	1	0	1	5	2	0	0	0	0	0	1	2	2	1
Sphaerocysta brasiliensis	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	1	2	0	0	1	0	1	1	0	0	0	1	0	1	0	1	2	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Sphaercysta costai	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	0	3	0	0	0	-	?	1	0	0	0	1	0	1	0	1	2	1	0	1	1	3	1	2	0	0	0	0	0	0	1	0	3	?
Sphaerocysta egregia	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	0	2	1	0	0	-	1	1	0	0	0	0	-	1	0	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	1
Sphaerocysta fumosa	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	1	1	1	2	0	3	1	0	0	-	?	1	0	0	2	1	0	0	0	1	2	-	-	-	-	-	1	5	2	0	0	0	0	0	1	2	2	1
Sphaerocysta globifera	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	1	2	0	0	1	1	1	1	0	0	0	1	0	1	0	1	2	1	0	1	1	3	1	0	0	0	0	0	0	0	0&1	0	1	1
Sphaerocysta inflata	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	1	1	1	2	0	2	1	0	0	-	0	1	0	0	2	1	0	1	0	1	0	1	0	1	1	0	1	5	2	0	0	0	0	0	1	2	2	1
Sphaerocysta nosella	0	0	1	1	0	0	0	1	1	1	0	0	1	0	0	0	0	1	1	1	2	2	2	1	1	0	-	0	1	0	0	0	1	1	1	0	1	0	1	0	1	1	0	1	5	2	0	0	0	0	0	0	-	2	1
Sphaerocysta paris	0	0	?	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	0	2	1	0	0	-	1	1	0	0	0	1	0	1	0	1	0	1	0	1	1	0	1	3	0	0	0	0	0	0	1	0	0	1
Sphaerocysta propria	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	1	1	0	0	1	0	1	1	0	0	0	1	0	1	0	1	2	1	0	1	1	3	1	0	0	0	0	0	0	0	0	-	0	1
Sphaerocysta ruthae n. sp.	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	2	1	1	1	-	3	1	0	0	-	0	1	0	0	2	1	0	1	0	1	0	1	0	1	1	1	1	5	2	0	2	0	0	0	1	2	2	1
Sphaerocysta stali	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1	2	1	2	0	0	1	1	1	1	0	0	0	1	0	1	0	1	2	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1
Derephysia foliacea	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	1	4	0	1	1	-	2	1	0	0	-	0	1	1	0	2	0	-	1	1	1	0	1	0	1	0	0	1	4	1&2	0	2	0	0	1	1	0	1	
Dicysta amica	0	0	0	2	0	0	0	1	1	1	0	0	0	0	0	0	0	3	1	1	1	-	3	1	0	0	-	0	0	1	0	-	1	1	0	0	1	0	-	-	-	-	-	1	2	2	0	1	0	0	0	0	1	1	1
Dicysta fonsecai	0	0	0	3	0	0	0	0	0	-	-	-	1	1	0	0	0	4	1	1	1	-	3	1	0	0	-	0	0	0	0	-	1	1	0	0	1	0	-	-	-	-	-	1	2	2	0	2	0	0	0	0	1	1	1
Dicysta hollandi	0	0	0	2	0	0	0	1	1	1	0	0	1	0	1	0	0	2	1	1	1	-	3	1	0	0	-	0	0	0	0	-	1	1	0	0	1	0	-	-	-	-	-	1	2	2	0	1	1	0	0	0	1	1	1
Dicysta lauta	0	0	0	2	0	0	0	1	1	2	0	0	1	0	0	0	0	3	0	1	1	-	3	1	0	0	-	0	0	0	0	-	1	1	0	0	1	0	-	-	-	-	-	1	2	0	0	2	1	?	0	0	2	1	1
Dicysta limata	0	0	0	2	0	0	0	1	1	1	0	0	1	0	0	0	0	4	1	1	1	-	3	1	0	0	-	0	0	0	0	-	1	1	0	0	1	0	-	-	-	-	-	1	2	2	0	2	0	0	0	1	0	1	1
Dicysta smithi	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	1	1	-	3	1	0	0	-	0	1	0	0	2	1	0	0	0	1	0	-	-	-	-	-	1	2	2	0	1	0	0	0	1	2	1	1
Dicysta vitrea	0	0	0	2	0	0	0	1	1	2	0	0	1	0	1	0	0	3	1	1	1	-	3	1	0	0	-	0	0	0	0	-	1	1	0	0	1	0	-	-	-	-	-	1	0	0	0	2	1	0	1	0	2	1	1
Galeatus peckami	0	0	?	1	1	1	1	1	1	0	0	0	?	0	0	0	1	?	?	1	3	-	3	1	0	0	-	0	1	0	0	0	1	?	1	0	1	1	1	1	0	1	2	1	0	1	0	2	0	0	0	0	-	1	1
Kalama tricornis	0	0	0	1	1	0	0	0	1	2	0	0	0	0	0	0	1	3	3	1	0	-	0	1	0	0	-	0	1	0	0	2	0	-	1	0	1	0	1	0	1	0	0	1	1	0	0	2	0	0	0	1	0	1	0
Leptocysta novatis	0	0	1	2	1	1	1	1	1	1	0	0	1	1	0	0	1	3	1	1	3	-	3	1	0	0	-	0	1	0	0	2	0	-	1	0	1	0	1	0	1	0	1	1	0	1	0	2	1	0	1	1	1	1	1

Leptocysta sexnebulosa	0 0 1 1 1 1 1 1 1 1 0 0 1 1 0 0 1 2 1 1 3 - 3 1 0 0 - 0 1 1 0 2 0 - 1 0 1 0 1 0 1 0 1 1 0 1 0 2 0 1 0 1 1 1 1
Teleonemia scrupulosa	0 0 1 0 0 0 1 1 1 1 1 0 1 0 0 1 0 2 2 1 0 - 1 1 0 0 - - 1 1 1 2 0 - 1 0 1 0 1 0 1 0 0 1 0 0 2 0 0 0 0 0 - 0 1
Tingis americana	1 1 1 0 1 1 1 0 1 1 0 1 1 0 0 1 0 0 1 1 0 - 0 1 0 0 - - 1 1 1 2 0 - 1 1 0 - 0 - 1 - 2 1 1 1 0 0 0 1 0 1 1 1 1
Tingis colombiana	1 1 1 0 ? ? 1 1 1 1 0 1 1 0 0 1 0 3 1 1 0 - 0 1 0 0 - - 1 1 1 2 0 - 1 1 0 - 0 - 1 - 2 1 4 0 0 0 0 1 0 1 0 1 1
Ulotingis decor	0 0 0 1 1 0 1 1 1 0 0 0 1 0 0 1 0 3 1 0 - - - - - - - - 1 1 1 2 0 - 1 1 0 - 0 - 2 - 0 1 1 0 0 0 0 0 0 0 - 1 1
Ulotingis nitoris	0 0 1 0 1 1 1 1 1 1 0 0 1 0 0 1 0 3 1 0 - - - - - - - - 1 1 1 2 0 - 1 1 0 - 0 - 2 - 0 1 1 0 0 0 0 0 0 1 - 1 1
Psilobyrsa vriesiae	0 0 1 1 1 1 0&1 1 1 0 0 0 1 1 0 0 0 2 1 1 0 - 0 0 0 0 - - 1 0 0 1 0 - 1 0 0 - 0 - 1 - 0 0 0 - - - 0 0 0 - - -

Table 1. Character matrix with 84 characters for 31 taxa. Symbols: -, inapplicable; ?, missing data; &, multiple states.

	6 7 8 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
Sphaerocysta angulata	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 2 1 1 2 1 1 1 0 2 0 0 0 2
Sphaerocysta biseriata	0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 2 1 0 2 2 1 1 1 0 2 0 2 0 1
Sphaerocysta brasiliensis	0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 2 2 1 1 2 1 1 1 0 0 0 1 0 2
Sphaercysta costai	? 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 2 0 1 1 1 1 1 ? ? ? 0 0 ?
Sphaerocysta egregia	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 2 1 1 2 1 1 1 0 0 0 1 0 1
Sphaerocysta fumosa	0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 2 1 0 2 2 1 1 1 0 1 0 2 0 1
Sphaerocysta globifera	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 2 1 1 2 0 1 1 0 0 0 0 0 1
Sphaerocysta inflata	0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 2 1 1 2 2 1 1 1 0 1 0 2 0 1
Sphaerocysta nosella	0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 2 2 1 2 2 1 1 1&2 0 0 0 2 0 2
Sphaerocysta paris	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 2 1 1&2 2 1 1 1 0 0 0 1 0 1
Sphaerocysta propria	? 0 0 1 0 1 0 0 0 0 0 0 0 0 0 2 1 1 1 2 1 1 1 0 0 0 1 0 2
Sphaerocysta ruthae n. sp.	0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 2 1 0 2 2 1 1 1 0 0 0 2 0 1
Sphaerocysta stali	0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 1 1 1 2 0 1 1 0 0 0 0 0 1
Derephysia foliacea	1 2 0 1 0 0 1 0 0 0 0 0 0 0 0 0 - 0 - 1 1 - - 1 0 2 0 1 0 1
Dicysta amica	2 0 0 0 1 1 0 0 0 0 0 0 0 1 0 2 0 0 2 0 1 1 1 0 0 0 2 0 0
Dicysta fonsecai	1 0 0 0 0 1 0 0 0 0 0 0 0 1 0 2 0 0 2 1 1 1 1 0 0 0 2 0 0
Dicysta hollandi	2 0 1 0 0 1 0 0 0 1 0 0 0 1 0 2 2 1 1 1 1 1 1 1 0 0 2 0 0
Dicysta lauta	1 0 0 0 0 1 0 0 0 0 0 1 0 1 0 2 0 0 2 0 1 0 1 0 0 0 2 0 0
Dicysta limata	1 0 0 0 0 1 0 0 0 0 0 1 1 1 0 2 0 0 1 1 1 1 1 1 0 0 2 0 0
Dicysta smithi	1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 0 0 2 2 1 1 1 0 0 0 1 0 0
Dicysta vitrea	2 0 1 2 0 1 0 0 0 0 0 1 0 1 0 2 0 0 2 0 1 1 1 1 0 0 2 0 0
Galeatus peckami	0 ? ? ? ? ? ? ? 1 0 0 1 0 0 0 0 0 0 3 2 ? 1 3 ? ? ? ? 0 0
Kalama tricornis	- 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 2 1 1 1 1 2 0 1 0 2 0 2
Leptocysta novatis	2 0 0 0 0 1 2 0 0 0 0 0 0 1 0 0 0 2 2 1 0 2 2 0 1 1 2 0 1
Leptocysta sexnebulosa	2 0 0 0 0 1 2 0 0 1 0 0 1 1 0 0 0 2 2 0 0 2 2 0 1 1 2 0 1
Teleonemia scrupulosa	1 1 0 1 0 1 2 1 0 0 0 1 1 0 1 0 0 2 2 1 - 1 1 0 2 0 0 1 2
Tingis americana	0 1 0 3 0 1 0 1 0 0 1 0 0 0 1 0 0 2 0 2 1 1 0 0 2 0 1 1 2
Tingis colombiana	? 1 0 1 0 1 2 1 0 0 1 0 0 0 1 0 0 2 0 2 1 1 0 0 2 0 1 1 2
Ulotingis decor	0 1 0 1 0 1 2 1 0 0 0 0 0 0 0 0 0 1 1 2 1 1 1 0 2 0 1 1 2
Ulotingis nitoris	0 1 0 3 0 1 0 0 0 0 0 0 0 0 0 0 1 2 1 2 1 1 1 ? ? ? 0 0 2
Psilobyrsa vriesiae	1 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 1 0 1 1 1 1 1 0 0 0 2 1 1

Table 2. Acronyms of the institutions and collections visited or consulted.

Institutions/Collections	**Acronyms**
American Museum of Natural History	AMNH
Carnegie Museum of Natural History	CMNH
Coleção Entomológica “Adolph Hempel”	CEAH
Florida State Collection of Arthropods	FSCA
Instituto Alexander von Humboldt	IAVH
Instituto Nacional de Pesquisas da Amazônia	INPA
Museo de La Plata	MLPA
Museu Anchieta	MGAP
Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul	MCNZ
Museu de Entomologia da Universidade Federal de Viçosa	UFVB
Museu de Entomologia Pe. Jesus Santiago Moure	DZUP
Museu de História Natural Capão da Embuia	MNCE
Museu de Zoologia da Universidade de São Paulo	MZSP
Museu Nacional, Universidade Federal do Rio de Janeiro	MNRJ
Museu Paraense Emilio Goeldi	MPEG
Museúm National d'Histoire Naturelle	MNHN
National Museum of Natural History	USNM
Swedish Museum of Natural History	NHRS
Universidade Federal do Rio Grande do Sul, Instituto de Biociências	UFRG

Apendix 1. List of morphological characters used in the cladistic analysis.

HEAD

1. Antennae, scape, general color: same (0) or darker (1), than basiflagellomere.
2. Antennae, pedicel, general color: same (0) or darker (1), than basiflagellomere.
3. Antennae, distiflagellomere, general color: same (0) or darker (1), than basiflagellomere.
4. Antennae, scape, size: slightly (0), two-times (1), three-times (2), or four-times (3), longer than the pedicel (modified from Guilbert, 2004: character 38).
5. Antenniferous process, shape: not acuminated (0); acuminated (2).
6. Antenniferous process, direction: forward (0); downwards (1).
7. Cephalic spines, occipital: absent (0); present (1) (Montemayor & Costa, 2009: character 6).
8. Cephalic spines, medial: absent (0); present (1).
9. Cephalic spines, frontal: absent (0); present (1) (Montemayor & Costa, 2009: character 5).
10. Cephalic spines, frontal, apex, position: parallel (0), convergent (1), or

strongly convergent (2), relative to each other.

11. Cephalic spines, setae with simple base: absent (0); present (1).
12. Cephalic spines, setae with cubic base: absent (0); present (1).
13. Bucculae, anterior region: open (0); closed (1) (Guilbert, 2000: character 21).
14. Bucculae, position: not projected (0) or projected (1), in front of the head.
15. Bucculae, scale-like projections: absent (0); present (1).
16. Bucculae, pubescence: absent (0); present (1) (modified from Lis, 1999: character 17).
17. Bucculae, outer row, areolas: same size (0) or larger (1), than the areolas from inner rows.
18. Rostrum, reach: to the anterior region of mesoesternum (0); to the posterior region of mesosternum (1); to the anterior region of the metasternum (2); to the posterior region of the metasternum (3); to the abdomen (4) (modified from Guilbert, 2000: character 22).
19. Rostrum, color, pattern: uniform (0), apex darker (1), posterior half darker (2) or anterior half darker.

THORAX

20. Hood: absent (0); present (1) (Lis, 1999: character 11).

21. Hood, shape: slightly elevated (0), oval (1), spherical (2), or slender (3).
    Hoods longer than wide are considered oval (Figs. 6f, 8e), where hoods with length subequal to their width are considered spherical (Figs. 6a-e, 8a-d).
22. Hood, spherical, anterior region: rounded (0), thin (1), or tapered (2).
23. Hood, projection: not projected (0), slightly projected, not reaching eyes (1); strongly projected, surpassing eyes (2) or fully-projected, surpassing the clypeous (3).
24. Hood, areolas, average size: larger (0), or subequal (1), than the pronotal disc areolas/punctuation.
25. Hood, areolas, shape: generally uniform (0); not uniform (1).
    The hood's areola shape can differ among them, and therefore, they can be uniform (Fig. 8b) and not uniform (Fig. 8c).
26. Hood, postero-dorsal, conspicuously larger areolas: absent (0); present (1).
    Sphaerocysta globifera, *S. stali*, *S. brasiliensis* and *S. propria* presented this larger areola in the postero-dorsal area of the hood (Fig 8a, 8d).
27. Hood, postero-dorsal, conspicuously larger areolas, position: close (0) or far (1), from the central vein of the hood.
    Sphaerocysta globifera and *S. stali* present these larger areolas far from the central vein of the hood (Fig. 6c, 8a), whereas *S. brasiliensis* and *S. propria* presents they close to this vein (Fig. 8d).

28. Hood, postero-ventral, conspicuously larger areolas: absent (0); present (1).
29. Pronotum, posterior projection, areolas: absent (0); present (1);
30. Pronotum, posterior projection, areolas, size: same size (0) slightly bigger (1), or at least two-times (2) the size of the areolas on the pronotal disc.
31. Pronotum, disc, pubescence: absent (0); present (1) (modified from Cassis & Celia, 2011: charaacter 31).
32. Pronotum, posterior projection, pubescence: absent (0); present (1).
33. Pronotum, posterior projection, cyst: absent (0); present (1).
34. Pronotum, posterior projection, cyst, base: areolated (0); not areolated (1).
35. Pronotum, carinae, number: one (0); three (1) (modified from Lis, 1999: character 05).
36. Pronotum, carinae, pubescence: absent (0); present (1).
37. Pronotum, median carinae, shape: carinae-like (0); areolated (1).
38. Pronotum, median carinae, areolas, disposition: throught the entire pronotum (0), only at the pronotal disc (1), or only at the pronotal posterior projection (2).
39. Pronotum, lateral carina, shape: carinae-like (0); areolated (1).
40. Pronotum, lateral carina: unfolded (0); folded (1).
41. Pronotum, lateral carina, disposition: only on the disc (0), present also on the pronotal posterior projection (1), or mainly at the pronotal posterior

projection (2).

42. Pronotum, lateral carina, areolas, disposition: throught the entire pronotum (0), only at pronotal disc (1), or only at pronotal posterior projection (2).
43. Pronotum, lateral carina, pronotal disc, disposal: parallel (0); divergent (1); convergent (2); sinous (3).
44. Paranota, shape: carinae-like (0); areolated (1).
45. Paranota, form and arrangement: uniform (0); anterior region bigger (1), or posterior region bigger (2) than the others; anterior and posterior region subequal and bigger than the medial region (3) anterior and medial region subequal and bigger than posterior region (4) or posterior and medial region subequal and bigger than the anterior (5).

The paranota was divided into three areas of equal length, in order to describe its shape precisely. Beside the width of these areas, the elevation of paranota is also a crucial feature to define the shape of such structure in different species. Here, we used only the development of the paranota divided into these three areas. Paranota with the anterior region as the biggest (Fig. 6b), posterior region as the biggest (Fig. 6e), anterior and posterior region subequal and bigger than median region and posterior and medial region subequal and bigger than anterior region (Figs. 6d, 6f) are illustrated.

46. Paranota, position: not projected (0); anteriorly projected (1); posteriorly projected (2).
47. Paranota: unfolded (0); folded with (1) or folded without (2), contacting the pronotum surface.
48. Paranota, elevation, in relation to the height of the hood: not elevated (0); below the half, (1); to the half (2), or higher (3).
49. Paranota, scale-like projections: absent (0); present (1).
50. Paranota, spines: absent (0); present (1).
51. Paranota, pubescence: absent (0); present (1).
52. Paranota, areolas, rows, number: equal (0) or unequal (1), over the entire paranota.
53. Paranota, areolas, inner row, size: subequal (0), smaller (1) or strongly smaller (half the size, 2), than the outer rows.
54. Paranota, posterior angle: straight (0), rounded (1), lobulate (2), or acutely projected (3).
55. Sternal lamina: carinated (0); areolated (1).
56. Sternal lamina, areolas, shape: wider than higher (0); squared (1); higher than wider (2).
57. Sternal lamina, pubescence: absent (0); present (1).
58. Sternal lamina, scale-like projections: absent (0); present (1).

59. Mesosternal laminae, disposal: straight (0), concave (1), or convex (0), relate to each other; or sinuous (3).

60. Mesosternal laminae, posterior edges: wider (0) or the same (1), than the anterior edges.

61. Metasternal laminae, form: straight (0), or concave (1), relate to each other (modified from Guilbert, 2001: character 35).

62. Metasternal laminae, posterior edges: narrower (0), wider (1), or the same (2) than the anterior edges.

63. Rostral channel, pubescence: absent (0); present (1).

HEMELYTRA

64. Outer margin, anterior region, fold: absent (0); present (1).

    A conspicuous fold in the anterior region of the hemelytra is present in some species of *Sphaerocysta* (Figs. 3b, 3f, 7b, 7c, 10a).

65. Outer margin, edge, scale-like projections: absent (0); present (1).

66. Outer margin, edge, spines: absent (0); present (1).

67. General shape, widening pattern: only at anterior half (0); also at posterior half (1).

68. General shape, constriction: absent (0); present (1).

69. Inner margin, posterior region, shape: rounded (0); straight (1).

70. Veins, pubescence: absent (0); present (1).
71. RM+Cu veins, junction: not raised (0), slightly raised (1), or strongly raised, forming a cyst (2) (modified from Guilbert, 2000: character 45).
72. Cu vein, apex: straight (0); slightly curved (1); strongly curved (2) (modified from Montemayor & Costa, 2009: character 19).
73. Discoidal area, length: smaller (0), subequal (1), or longer (2) than half of the length of hemelytra.
74. Costal area, posterior cells, outer row, general shape: rounded (0); squared (1); rectangular, longer than wide (2); rectangular, wider than longer (3).
75. Costal area, posterior cells, average size: smaller (0), subequal (1) or larger (2), than the average size of the sutural area areolas.
76. Subcostal area, areolas, outer row, size: smaller (0), or subequal (1), to the areolas of the inner row.
77. Discoidal area, areolas, average size: smaller (0), subequal (1) or larger (2), than the average size of the areolas of the subcostal area.
78. Sutural area, cells, inner row, general shape: rounded (0); squared (1); rectangular, longer than wide (2); rectangular, wider than longer (3).
79. Hipocostal area, outer margin, scale-like projections: absent (0); present (1).
80. Hipocostal area, areolas area, reach: before the abdominal posterior margin (0), at the abdominal posterior margin (1) or after abdominal posterior

margin (2).

81. Hipocostal area, apex: evanescent (0); abruptly ended (1).

ABDOMEN

82. General shape: oval (0), subrounded (1), or rounded (1).
83. Pubescence: absent (0); present (1).
    84. Length: less than two-thirds (0), two-thirds (1), or slightly surpassing two-thirds (2), of the hemelytra lenght.

Considerações Finais

Este trabalho contribuiu com a descrição de duas novas espécies, pertencentes ao gênero *Sphaerocysta*, sendo que *S. ruthae* n. sp. foi a primeira espécie descrita para o gênero com um capuz ovalado e não esférico, ampliando assim a descriçao do gênero. *Sphaerocysta costai* n. sp. apresenta adultos notavelmente semelhantes aos adultos de *S. angulata*, enquanto os imaturos apresentam uma diferença intragenérica incomum na família Tingidae. As redescrições foram padronizadas, e diagnoses diferenciais foram apresentadas. Os novos registros ampliaram a distribuição das espécies e do gênero como um todo, uma vez que a ocorrência de *S. fumosa* no Panamá foi o primeiro registro do gênero para a América Central. *Sphaerocysta maculata* foi considerada sinônimo júnior de *S. propria*, e as sinonímias de *S. stali* com *S. globifera* e *S. brasiliensis* com *S. propria* foram hipotetizadas mas não estabelecidas. Isso ocorreu devido a falta de evidências, uma vez que estas espécies foram raramente coletas e poucos especimes foram encontrados nas coleções visitadas.

A reanálise da matriz publicada por Guilbert (2004) após a inclusão das espécies de *Sphaerocysta* com dados de imaturos (*S. angulata, S. costai* n. sp., *S. inflata*) permitiu o questionamento de hipóteses evolutivas da morfologia dos imaturos de Tingidae propostas por este autor. No entanto, uma nova análise, explorando as estratégias de buscas, com novos caracteres e com a adição de mais táxons deveria ser conduzida para um melhor teste destas hipóteses de padrões evolutivos. Acreditamos que os resultados atingidos neste trabalho serviram para re-abrir a discussão destas hipóteses. A análise filogenética do gênero corroborou a hipótese de monofilia do mesmo, sendo o clado suportado por duas homoplasias. Até então, todas as análises filogenéticas morfológicas conduzidas em Tingidae demonstraram um alto índice de homoplasias. Sendo assim, consideramos a hipótese de monofilia e mantivemos o gênero como válido. Os clados das espécies *S. brasilensis* + *S. propria*, e *S. globifera* + *S. stali*, que foram consideradas possíveis casos de sinonimías, foram resgatados e são clados-irmãos. Este era um resultado esperado devido a alta similaridade morfológica apresentada por estes dois pares de espécies. O grupo irmão do gênero foi *Dicysta*, que, com sete espécies incluídas também foi recuperado como monofilético. Mesmo que a análise não tenha sido desenhada para o teste da monofilia de *Dicysta*, e que nem todas as espécies deste gênero foram incluídas, acreditamos que nossos resultados também aumentam as evidências para a monofilia deste táxon.

O presente estudo contribuiu para o conhecimento sistemático dos tingídeos Neotropicais, mais especificamente do gênero *Sphaerocysta*. A descrição de *S. costai* n. sp. com os imaturos de quinto ínstar evidenciou a falta de conhecimento nessa forma de vida em Tingidae e a necessidade de mais estudos básicos e descritivos de ninfas na família. A filogenia do gênero visa também contribuir com novos caracteres para futura análises filogenéticas de nível genérico em Tingidae. No entanto, esforços adicionis são necessários para uma compreensão mais ampla da sistemática do gênero, com por exemplo, a descrição dos imaturos de todas as espécies de *Sphaerocysta* e a aplicação dos caracteres deste estágio de vida em análises filogenéticas do gênero, bem como a inclusão de caracteres moleculares.

Anexo I

European Journal of Entomology – Instructions for Authors

General

The European Journal of Entomology (EJE) is an international journal covering the whole field of general, experimental, systematic and applied entomology. Manuscripts generally should not exceed 30 pages (exceptions are possible, particularly in case of reviews, and should be negotiated in advance with the editors). Papers are considered by referees before acceptance. Authors will receive first editorial decision within 8 weeks from confirmed submission. All contributions are published in English. Authors whose mother tongue is not English are strongly urged to have their manuscripts reviewed linguistically before submission. Papers written in poor English will be returned. It is understood that manuscripts submitted to EJE have not been offered to any other journal for prior or simultaneous publication.

Scope

EJE publishes original articles, points of view and reviews on all aspects of entomology. There are no restrictions on geographic region or taxon (Myriapoda, Chelicerata and terrestrial Crustacea included). Comprehensive studies and comparative/experimental approach will be preferred and the following types of manuscripts will be usually declined:

Descriptive alpha-taxonomic studies unless the paper is markedly comprehensive/revisional taxonomically or regionally, and/or significantly improves our knowledge of comparative morphology, relationships or biogeography of the higher taxon concerned.

Other purely descriptive papers [(ultra)structural and functional details, life histories, geographical distribution, etc.] unless they concern data or taxa of particular phylogenetic interest.

Papers evaluating the effect of chemicals, irradiation, or dealing with data of agro-economic impact without general entomological relevance.

Authors must respect the articles of the International Code of Zoological Nomenclature (Fourth Edition, 1999) and its relevant recommendations, particularly Recommendation 16C concerning the deposition of name-bearing types in appropriate institutions.

Proofs and page charges

Proofs will be sent to the authors for correction. No page charges are levied for articles up to 20 printed pages. Authors (particularly those with institutional support) are expected to pay EUR 25 for each printed page exceeding 20. One colour page is printed gratis, EUR 100 is charged for each additional page containing colour artwork. A PDF file is supplied free of charge. Reprints or free PDF access can be ordered at cost when you return your page proof (late orders of reprints cannot be accepted). Prices can be found here. Manuscripts of both published and rejected papers and originals of illustrations are not returned, unless requested.

Contact

Editorial office: European Journal of Entomology, c/o Institute of Entomology, Branisovska 31, CZ-37005 Ceske Budejovice, Czech Republic. Phone: (+420) 387775214. Fax: (+420) 385310354. E-mail: eje@eje.cz. Web page: http://www.eje.cz.

Preparation of manuscript

Heading: Give title, full name(s) of author(s) [surname(s) in capital letters], and place of work with full address including e-mail address if available, each on a separate line. Title should omit authors of taxa and years of description, and, where appropriate, should contain names of higher taxa accommodating the insects under study, typically order and family, e.g., (Diptera: Muscidae).

Key words: Select a set of key words (index terms). The set should be complete (i.e., words from the title should be repeated if considered index terms).

The abstract should summarize the contents of the paper and indicate the relevance of the work. Adopt standard scientific nomenclature, avoid abbreviations and quotations. Abstracts of taxonomic papers should mention all nomenclatural acts and list newly proposed nominal taxa.

The standard order of sections for original papers is: Introduction, Material and methods, Results, Discussion and conclusions (the last two sections may be combined), Acknowledgements, References, Footnotes, Tables, Figure legends. Use footnotes sparingly, and number them consecutively throughout the text. Each genus- and species-group name mentioned should appear at least once (preferably when first used, or in Material and methods) in connection with its author (plus year of description in taxonomic papers), but do not quote the author on each occasion. Do not abbreviate authors' names. Interpret specimen labels and geographical data consistently throughout the paper, using current spelling of geographical names. If for some reason (primary types or other important specimens, difficult interpretation, incomplete data) you want to quote a label, place these data between quotation marks.

Use British Standard System for the transliteration of Cyrillic characters (available from the editors on request).

References: (a) Within the text: Tröster (1990); (Lawrence, 1992); Brothers & Finnamore (1993); Enghoff et al. (1993). All publications referred to in the text (including synonymical lists of taxonomic papers) must be cited in full in the list of references. (b) Under References: Put authors in alphabetical sequence, with multiple papers of the same author arranged chronologically. Cite all authors and full title. Do not capitalize authors' names. In journal articles, separate title and journal’s name by an m-dash (—) (see examples below). Abbreviate names of periodicals basically according to the World List of Scientific Periodicals, 4th Edition, Butterworths, London, 1964–1965 (if you are not certain about the correct abbreviation, give the journal's name in full). If each paper appears as a separate (and separately paginated) number, use example 2 below. Titles of papers published in languages other than English, German, French, Spanish, Portuguese, and Italian should be replaced by an English translation, with an explanatory note at the end, e.g., (in Russian, English abstr.). Conference proceedings should be cited as monographs (i.e., with publisher and place), not as periodicals. Number of pages is required for monographs.

Examples:

Enghoff H., Dohle W. & Blower J.G. 1993: Anamorphosis in millipedes (Diplopoda) – the present state of knowledge with some developmental and phylogenetic considerations. — Zool. J. Linn. Soc. 109: 103–234.

Tröster G. 1990: Der Kopf von Hybophthirus notophallus (Neumann) (Phthiraptera: Anoplura). Eine funktionsmorphologische und konsequent-phylogenetische Analyse. — Stuttg. Beitr. Naturk. (A) No. 442, 89 pp.

Lawrence P.A. 1992: The Making of a Fly. The Genetics of Animal Design. Blackwell Scientific, Cambridge, MA, 228 pp.

Brothers D.J. & Finnamore A.T. 1993: Superfamily Vespoidea. In Goulet H. & Huber J.T. (eds): Hymenoptera of the World: An Identification Guide to Families. Agriculture Canada, Ottawa, pp. 161–278.

Use italics as follows: In the text: Latin names of taxa up to the generic level. In the References: Latin names of taxa, names of periodicals and titles of books. If your software has that option, use the Small Capitals typeface for author names in the list of references (but never type them in capitals from your keyboard).

When preparing illustrations and tables, please consider the journal's printed page size, which is 170x247 mm, column width 82.5 mm. Illustrations (including graphs) and their caption or legends should form a separate, fully self-explanatory unit. Explain abbreviations in the legends, or (if too numerous) collect them elsewhere in a list (preferably under Material and methods). Do not use very fine lines or dots in drawings that are to be significantly reduced (in computer lineart files, lines and dots should be at least three pixels wide at print size). Illustrate fine details separately sufficiently enlarged and do not include them in overviews which must then be printed oversized. Illustrations should be arranged into blocks or plates by the authors. Use pre-printed or computer lettering of sufficient size to permit reduction. Photographic prints are best submitted at the actual size of reproduction. If the editors are to insert the final lettering, indicate your requirements on a printed copy. Morphological illustrations (if not schematic) must include a scale bar. Tables should include headings and explanations, and should be numbered consecutively. Approximate position of figures and tables should be indicated in the manuscript. References in the text to illustrations and tables: Fig. 1; Figs 1–3; Table 1.

Submission

Manuscripts for review should be always submitted through our electronic submission system (please use text line numbering to make the work easier for our reviewers). The final text accepted for print must be supplied in an editable electronic form preferably accompanied by a printed copy. Rich Text Format (.RTF) or MS Word (.DOC) files are preferred. Users of Apple computers should submit the text either in a format directly transferable to PC, or as a plain text file. Format the text as simply as possible and do not try to match the journal's appearance, we will completely reformat all accepted papers and remove all formatting options except for italics and small capitals.

If possible, graphics for print should be provided in an electronic form in some common bitmap graphic format, such as Tagged Image File Format (.TIF). Non-bitmap graphic files are not accepted. Never submit graphics imported into a word processor format (e.g., as .DOC files). Required modes and minimum resolutions for bitmap graphic files: Colour in 24-bit RGB mode, 400 dpi at print size; halftones in 8-bit grayscale mode, 400 dpi at print size; line art in 1-bit black-and-white mode, 1,200 dpi at print size. See here for additional information about submitting computer graphics. Original artwork may be required for best printing quality.

Editorial: Taxonomic papers published in EJE

1. Authors must follow all requirements of the current International Code of Zoological Nomenclature. The recommendations of the Code should also normally be

followed. If an author wants to circumvent any recommendation, convincing reasons should be stated.

2. This journal requires that at least holotypes be deposited in public collections that provide long-term care and access for study. (Note that this is mandatory for neotypes.) If possible, use the collection abbreviations available at http://hbs.bishopmuseum.org/codens/codens-inst.html.

3. All new taxonomic acts (new taxa, new synonyms, new combinations, etc.) must be listed in full in the Abstract. The list of synonymized names must indicate their disposition (i.e., with what other name they have been synonymized). Original references should be always included for all newly synonymized or combined names.

4. The standard order of sections within a species treatment is: Diagnosis, Description, Material, Etymology, Distribution, Biology, and other comments if appropriate.

5. Good illustrations are essential unless the paper solves purely nomenclatoric problems. All morphological illustrations, if not schematic, must be provided with scale bars. We encourage particularly authors dealing with poorly known, rare or

exotic taxa to provide as complete illustrations as possible, including habitus drawings or photographs of selected representatives of the taxon under study.

6. Taxonomic papers should not be narrowly limited geographically, particularly if the limits are artificial political borders (which is undesirable). Authors should consider at least the complete regional fauna of the genus or subgenus under study. A more comprehensive geographic scope is required for taxa with broader distributions or with close relatives in other zoogeographic regions. It is the author's responsibility to know the group, both material and literature, well enough (preferably on a worldwide basis) to be able to ensure that all relevant taxa were taken into account and that any new taxa proposed have not already been described from elsewhere.

7. In the long run the phylogenetic approach to classification is the only valid one. (N.B. Phylogenetic analyses provide cladograms or phylograms, not classifications. Classification is arbitrary to a considerable extent, i.e., authors may differ in their opinions on translating a given phylogenetic tree into a practical classificatory system.) The taxonomic status of many groups does not allow such an approach without large revisionary studies which may be at the moment impossible for a given author. Therefore we will not insist on phylogenetic interpretations of the taxa concerned and we will accept papers that provide significant classificatory

advancements. However, taxonomic papers contributing at the same time to understanding of comparative morphology and phylogeny of the group under study will be preferred over alpha-taxonomic manuscripts.

8. The classificatory work should be done to a high standard. New species should not be described when the low-rank (generic, subgeneric, tribal) classification is in chaos unless the author tries to improve the situation so that species can be identified. Often the author just states that the new species is closest to species X, differing in some minute details, but the reader remains uncertain how to recognize X. This approach is acceptable only if the taxon has been recently revised with full identification keys; if so, the revision should be clearly referred to and the new species inserted in keys (comparative tables, etc.) published therein. Otherwise the author should define the relevant supraspecific group (genus or subgenus if not too large), or redefine it if the newly described taxa require that, and should provide a clear identification tool for its species. Again, that identification tool should not be narrowly limited geographically.

9. The range of variation is an important species attribute, and authors should properly understand the role of type material. Name-bearing type specimens serve to fix the application of names, not to determine what species should look like. We can characterize species entirely without reference to types, but then we need types in

order to attach names to these species. The type specimens, however, may be entirely non-typical and lying on the margin of the range of variation. It is therefore usually unnecessary to redescribe type material. Taxonomists solving a particular problem should see the type specimens, and all others need descriptions of species and their variation range, not just of the type specimens (whose peculiarities should be of course mentioned).

10. Characterization of a taxon does not consist exclusively of its morphology. Other characteristics, such as distribution, bionomics, behaviour, or molecular and genetic traits, may be very important and inclusion of these data is encouraged.

Editorial: A hopefully foolproof basic guide to submitting computer graphics

Like probably all journals, the European Journal of Entomology experiences frequent difficulties with authors who do not understand the computer graphic formats. This results in long and difficult discussions when we try to obtain their figures in a suitable electronic form, and since I usually become involved in those discussions sooner or later, I prepared the following text to help the authors to provide their graphics in a form we can use without performing breakneck transformations and without quality loss. Please note that all that follows concerns submission of final graphics for print. Graphic files for reviewers may be of lower quality suitable for evaluation of the results (see here for some additional details).

First, if your original figures are in a "hard" form (ink drawings on paper, photographic prints from negatives, photographic slides), we need the original(s). Do not try to scan or otherwise digitalize the originals yourself. Unless you have considerable experience in that type of work, we will probably do it better.

If, on the other hand, the "originals" are electronic (e.g., photographs produced by digital cameras, or graphics constructed directly in computer programs), we need them in an electronic form. Printing such files and then scanning them again will invariably spoil them considerably. If you do not feel sure, it is better that you do not try to "improve" your digital photographs; we will do it here, and probably better. For example, if you overcontrast your photograph in a graphic editor so that the light shades are white and the dark shades are black, there is nothing we can do to improve it - a reversal is not possible, and the information has been lost.

We accept graphics for print only as bitmap files (I will get to that in a moment), preferably in the Tagged Image File Format (TIFF, the files end with the suffix .tif). Other acceptable formats are Adobe Photoshop (.psd) or simple bitmap format (typically ends with .bmp, but the files saved in that format are huge and generally unsuitable for sending via e-mail and I do not recommend it). Virtually every reasonably good graphic editor, both for PC and Macintosh, can save TIFF files, so I strongly recommend using this format. The popular JPEG format (files ending in .jpg) uses compression algorithms which produce very small files but sacrifice some quality. You can send those files if they originated as such (e.g., from a digital camera), but never save your images in that format after you have modified them since you degrade them with every save. As we cannot guarantee that other types of files will open in our software exactly as you see them in yours, we cannot and will not use non-bitmap formats, such as vector formats (e.g., .cdr files produced by Corel Draw), encapsulated postscript (.eps), Microsoft Excel (.xls) or PowerPoint (typically .pps), Adobe Acrobat (.pdf), or Adobe Illustrator; also any proprietary Macintosh formats cannot be used even if they are bitmaps. Also, please never send your final graphics for print imported into a text (word processor) format, such as in the form of .doc files - this really makes me feel depressed.

Computer files are digital - nothing new. In the case of bitmap files, the picture consists of a rectangular network of small squares (called pixels) which are homogeneous and cannot be divided further (well, they can, but you will not obtain more detail). Open one of your bitmap files and enlarge it as far as your editor will permit and you will see what I mean. Therefore, if you once save your digital image in a bitmap file with low resolution (low number of pixels), there is no point in trying to enlarge it electronically - the information simply is not there. Keep that in mind.

Basically, your images may be line art, black and white halftones, or color. Correspondingly, you can save your .tif or .psd bitmaps in three modes (there are more, but we accept those three which are the most common). In the first mode (also called "bitmap" in Adobe Photoshop, which is somewhat confusing), your pixels can be only white or black (that means one bit of information for each pixel, but forget that if you do not know what a bit is). Save your line art in that format since your files will be much smaller. You can save line art in the following two modes as well, but you unnecessarily waste space and get nothing (in the better case, in the worst you may spoil the clarity and sharpness of details). The second mode is called "grayscale" in most editors, and every pixel can have one of 256 levels of gray, from completely white to completely black (that means 8 bits per pixel, in case you wondered). Save your black and white photographs, or any graphics that have levels of gray but no color, in that mode. Finally, the mode that we require for color graphics is called "RGB", an abbreviation of Red, Green and Blue, the three color channels composing the final color of each pixel. This format takes much more space because, in an uncompressed form at least, it requires 24 bits (8 per each color channel) of information to define the color of each pixel (let's not go into further detail).

Therefore use of this mode for saving grayscale or even line art graphics is suicidal. (Please note that you may have to pay for color artwork; see here)

Uncompressed TIFF files are about as large as simple bitmap files (and that means very large). However, better graphic editors offer an option of internal LZW compression of TIFF files (a compression algorithm introduced by Abraham Lempel, Jacob Ziv and Terry Welch). Unlike JPEG which, particularly at higher compression levels, causes considerable quality loss, the LZW compression is "lossless" and you can safely enable it to make your TIFF files slightly to considerably smaller (depends on the complexity of your picture). In Adobe Photoshop version 7 and up, you are also offered a possibility of internal JPEG compression of TIFF files - please never use that option.

Now we come to the magical and so often misunderstood word "resolution". Basically, this means the number of pixels there are per linear unit of the image. Traditionally, this is measured in pixels per inch (the abbreviation "dpi" is basically the same thing, meaning "dots per inch"). Per inch of printed image, that is - the word "resolution" actually has no meaning until you define how large the printed image will be. Nothing can prevent you from printing a given computer image as large or small as you choose, and yet the total number of pixels in that image will remain the same and therefore the resolution will be different for each print size.

The EJE requires the following resolutions for the three above mentioned modes: Line art (1 bit): 1,200 dpi at print size. Grayscale (8 bit): 400 dpi at print size. RGB color (24 bit): 400 dpi at print size. Higher resolution does not hurt (except making the files larger) but also does not help due to technical limits of the equipment used for printing the journal. Slightly lower resolution may be acceptable, but do not expect good prints for resolutions lower than 600 dpi for line art and 300 dpi for grayscale and color. Generally, we will not accept such low-resolution graphic files.

If you are still confused, an example might help. Let's suppose that you have a grayscale photograph that has 1,600 horizontal and 1,200 vertical pixels (if you do the multiplication, you will see that this image has approximately two millions of total pixels - this is what you get from a 2-megapixel digital camera). Information about image size in pixels for a given file can be obtained in any serious graphic editor - in Adobe Photoshop, for instance, open the file and go to Image, Image size. I have said that we require 400 dpi for grayscale. So how large can we print your image at 400 dpi? Obviously 4 inches (about 10 cm) wide and 3 inches (cca 7.5 cm) high. Taken from the other end, if you want your photograph 5x5 cm when printed, it should have at least 800x800 pixels.

If you have read this far, I thank you for your patience and for submitting your graphics to the EJE in suitable form and quality.

Petr Svacha

Anexo II

Zoological Journal of the Linnean Society – Instructions for Authors

Instructions for Authors

The Linnean Society publishes four periodicals: the Biological, Botanical and Zoological Journals, and The Linnean, the Society's newsletter and proceedings.

The Zoological Journal publishes papers on systematic and evolutionary zoology and comparative, functional and other studies where relevant to these areas. Studies of extinct as well as living animals are included.

Submissions to the Zoological Journal are now made on-line using ScholarOne Manuscripts. This includes any revised versions of previously submitted papers. To submit to the journal go to http://mc.manuscriptcentral.com/zoj. If this is the first time you have used the system you will be asked to register by clicking on 'create an account'. Full instructions on making your submission are provided. You should receive an acknowledgement within a few minutes. Thereafter, the system will keep you informed of the process of your submission through refereeing, any revisions that are required, and a final decision.

Conflict of Interest

The Zoological Journal of the Linnean Society requires that all authors disclose any potential sources of conflict of interest. Any interest or relationship, financial or otherwise, that might be perceived as influencing an author's objectivity is considered a potential source of conflict of interest. These must be disclosed when directly relevant or indirectly related to the work that the authors describe in their manuscript. Potential sources of conflict of interest include but are not limited to patent or stock ownership, membership of a company board of directors, membership of an advisory board or committee for a company, and consultancy for or receipt of speaker's fees from a company. The existence of a conflict of interest does not preclude publication in this journal.

It is the responsibility of the corresponding author to review this policy with all authors and to collectively list in a cover letter to the Editor, in the manuscript (under the Acknowledgement section), and in the online submission system ALL pertinent commercial and other relationships. Corresponding authors will be asked to confirm whether or not a conflict of interest exists as part of the submission process.

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Authors will be required to sign a Copyright Transfer Agreement Form (CTA) for all papers accepted for publication. Signature of the Copyright Transfer Agreement Form is a condition of publication and papers will not be put into production until a signed form has been received. (Government employees need to complete the Author Warranty sections, although copyright in such cases does not need to be assigned). After submission authors will retain the right to publish their paper in various media/circumstances (please see the form for further details). A copy of the form may be downloaded here.

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OnlineOpen is a pay-to-publish service from Wiley Blackwell that offers authors whose papers are accepted for publication the opportunity to pay up-front for their manuscript to become open access (i.e. free for all to view and download) via Wiley Online Library. Each Online Open article will be subject to a one-off fee of US$3000 to be met by or on behalf of the Author in advance of publication. Upon online publication, the article (both full-text and PDF versions) will be available to all for viewing and download free of charge.

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Prior to acceptance there is no requirement to inform an Editorial Office that you intend to publish your paper OnlineOpen if you do not wish to. All OnlineOpen articles are treated in the same way as any other article. They go through the journal's standard peer-review process and will be accepted or rejected based on their own merit.

Author material archive policy

All original hardcopy artwork for the three Linnean Society Journals will be returned to authors after publication. **Please note that, unless specifically requested, Wiley Blackwell will dispose of all electronic material and remaining hardcopy two months after publication.** If you require the return of any of this material, you must inform the editorial office upon submission.

Offprints

A PDF offprint of the online published article will be provided free of charge to the corresponding author, and may be distributed subject to the Publisher's terms and conditions. Paper offprints of the printed published article may be purchased if ordered via the method stipulated on the instructions that will accompany the proofs.

Manuscript preparation

Authors should aim to communicate ideas and information clearly and concisely, in language suitable for the moderate specialist. Papers in languages other than English are not accepted unless invited. When a paper has joint authorship, one author must accept responsibility for all correspondence; the full postal address, telephone and fax numbers, and e-mail address of the author who is to check proofs should be provided. **Please submit your manuscript in an editable format such as .doc or .rtf. If you submit your manuscript in a non-editable format such as PDF, this will slow the progress of your paper as we will have to contact you to request an editable copy.**

Papers should conform to the following general layout:

Title page

This should be uploaded as a separate file, designation 'Title Page'. It should include title, authors, institutions and a short running title. The title should be concise but informative, and where appropriate should include mention of family or higher taxon in the form: 'The Evolution of the Brown Rat, Rattus norvegicus (Rodentia: Muridae)'. A subtitle may be included, but papers in numbered series are not accepted. Names of new taxa should not be given in titles.

Abstract

This must be on a separate page. The abstract is of great importance as it may be reproduced elsewhere, and is all that many may see of your work. It should be about 100-200 words long and should summarize the paper in a form that is intelligible in conjunction with the title. It should not include references. The abstract should be followed by up to ten keywords additional to those in the title (alphabetically arranged and separated by hyphens) identifying the subject matter for retrieval systems.

Subject matter

The paper should be divided into sections under short headings. Except in systematic hierarchies, the hierarchy of headings should not exceed three. The Zoological Codes must be strictly followed. Names of genera and species should be printed in italic or underlined to indicate italic; do not underline suprageneric taxon names. Cite the author of species on first mention. Use SI units, and the appropriate symbols (mm, not millimetre; µm, not micron., s, not sec; Myr for million years). Use the negative index (m-1, l-1, h-1) except in cases such as 'per plant'). Avoid elaborate tables of original or derived data, long lists of species, etc.; if such data are absolutely essential, consider including them as appendices or as online-only supplementary material. Avoid footnotes, and keep cross references by page to an absolute minimum. Please provide a full English translation (in square brackets) for any quoted matter that is not in English.

References

We recommend the use of a tool such as EndNote or Reference Manager for reference management and formatting.

EndNote reference styles can be searched for here:

http://www.endnote.com/support/enstyles.asp

Reference Manager reference styles can be searched for here:

http://www.refman.com/support/rmstyles.asp

In the text, give references in the following forms: 'Stork (1988) said', 'Stork (1988: 331)' where it is desired to refer to a specific page, and '(Rapport, 1983)' where giving reference simply as authority for a statement. Note that names of joint authors are connected by '&' in the text. **When papers are by three authors, use all names on the first mention and thereafter abbreviate to the first name et al. For papers by four or more authors, use et al. throughout.**

The list of references must include all publications cited in the text and only these. Prior to submission, make certain that all references in the text agree with those in the references section, and that spelling is consistent throughout. In the list of references, titles of periodicals must be given in full, not abbreviated. For books, give the title, place of publication, name of publisher (if after 1930), and indication of edition if not the first. In papers with half-tones, plate or figure citations are required only if they fall outside the pagination of the reference cited. References should conform as exactly as possible to one of these four styles, according to the type of publication cited.

Burr FA, Evert RF. 1982. A cytochemical study of the wound-healing proteins in Bryopsis hypnoides. Cytobios 6: 199-215.

Gould SJ. 1989. Wonderful life: the Burgess Shale and the nature of history. New York: W.W. Norton.

Dow MM, Cheverud JM, Rhoads J, Friedlaender J. 1987b. Statistical comparison of biological and cultural/history variation. In: Friedlaender J, Howells WW, Rhoads J, eds. Solomon Islands project: health, human biology, and cultural change. New York: Oxford University Press, 265-281.

Gay HJ. 1990. The ant association and structural rhizome modifications of the far eastern fern genus Lecanopteris (Polypodiaceae). Unpublished D. Phil. Thesis, Oxford University.

Other citations such as papers 'in press' [i.e. formally accepted for publication] may appear on the list but not papers 'submitted' or 'in preparation'. These should be cited as 'unpubl. data' in the text with the names and initials of all collaborators. A personal communication may be cited in the text but not in the reference list. Please give all surnames and initials for unpublished data or personal communication citations given in the text.

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Anexo III

Lista de instituições e coleções científicas visitadas e consultadas

National Museum of Natural History (USNM) – Washington, D.C., Estados Unidos

American Museum of Natural History (AMNH) – Nova Iorque, Estados Unidos

Florida State Collection of Arthropods (FSCA) – Gainesville, Florida, Estados Unidos

Museúm National d'Histoire Naturelle (MNHN) – Paris, França

Instituto Alexander von Humboldt (IAVH) – Bogotá, Colômbia

Carnegie Museum of Natural History (CMNH) – Pittsburgh, Pensilvânia, Estados Unidos

Swedish Museum of Natural History (NHRS) – Estocolmo, Suécia

Museo de La Plata (MLPA) – La Plata, Buenos Aires, Argentina

Museu Nacional (MNRJ) – Rio de Janeiro, Brasil

Museu de Entomologia Pe. Jesus Santiago Moure (DZUP) – Curitiba, Paraná, Brasil

Museu Anchieta (MGAP) – Porto Alegre, Rio Grande do Sul, Brasil

Museu de Ciências Naturais (MCNZ) – Porto Alegre, Rio Grande do Sul, Brasil

Universidade Federal do Rio Grande do Sul, Instituto de Biologia (UFRG) – Porto Alegre, Rio Grande do Sul, Brasil

Museu de Historia Natural Capão da Embuia (MNCE) – Curitiba, Paraná, Brasil

Museu Paraense Emilio Goeldi (MPEG) – Belém, Pará, Brasil

Instituto Nacional de Pesquisas da Amazonia (INPA) – Manaus, Amazonas, Brasil

Museu de Entomologia da Universidade Federal de Viçosa (UFVB) – Viçosa, Minas Gerais, Brasil

Museu de Zoologia da Universidade de São Paulo (MZSP) – São Paulo, Brasil

Coleção Entomológica "Adolph Hempel" (CEAH) – São Paulo, Brasil