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# Revisão taxonômica e análise cladística do gênero *Novamundoniscus* Schultz, 1995 (Crustacea: Isopoda: Oniscidea)

Belém, 2018

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# Revisão taxonômica e análise cladística do gênero *Novamundoniscus* Schultz, 1995 (Crustacea: Isopoda: Oniscidea)

Tese/Dissertação apresentada ao Programa de Pós-Graduação em Zoologia, do convênio da Universidade Federal do Pará e Museu Paraense Emílio Goeldi, como requisito parcial para obtenção do título de Doutor/Mestre em Zoologia.
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**Orientador (a): Prof. Dr. Alexandre Bragio Bonaldo**
**Co-orientador (a): Prof. Dra. Paula Beatriz de Araújo**

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## RESUMO

O táxon Oniscidea (ordem Isopoda) foi criado por Latreille em 1802. A partir de Schmalfuss (1989), o monofiletismo de Oniscidea foi aceito, com base nos caracteres comuns a todos os Oniscidea. A família Dubioniscidae foi instituída por Schultz para incluir os gêneros *Dubioniscus*, *Calycuoniscus* e *Phalloniscus*, anteriormente alocados na família Bathytropidae, além do gênero *Novamundoniscus* para alocar as espécies das Américas previamente incluídas em *Phalloniscus*. O presente estudo teve, por objetivo, testar a hipótese de monofiletismo do gênero, estabelecendo relações de parentesco entre seus integrantes, com base em dados morfológicos. Elaborar uma hipótese de relacionamento filogenético entre *Novamundoniscus* e os demais gêneros de Dubioniscidae. Revisar *Novamundoniscus*, redescrevendo espécies conhecidas e descrevendo eventuais espécies novas. O trabalho é apresentado em capítulo único, dividido em duas partes (taxonomia e filogenia de *Novamundoniscus*). Ao todo, 18 espécies de *Dubioniscus*, *Novamundoniscus* e *Phalloniscus* foram analisadas e uma matriz com 73 caracteres foi gerada. A árvore final revelou o monofiletismo de Dubioniscidae, mas a inclusão de terminais adicionais torna-se necessária para confirmar as relações entre as espécies que compõem *Novamundoniscus*, que se revelou um clado parafilético no presente estudo. Os resultados da analise filogenética aqui apresentada são considerados provisórios, e como tal, as implicações taxonômicas da topologia discutida não foram adotadas na revisão de *Novamundoniscus*. Contudo, as otimizações dos caracteres nesta topologia fornecem conclusões importantes para o entendimento da história evolutiva dos táxons analisados e a matriz de caracteres proporciona uma base sólida para a continuidade desta linha de pesquisa.

**Palavras-chave:** Crinocheta; Filogenia; Neotropical.

## ABSTRACT

Oniscidea was erected by Latreille in 1802. From Schmalfuss (1989), monophytic Oniscidea was accepted, based on derivated characters common to all Oniscidea. Dubioniscidae was erected by Schultz to include the genera *Dubioniscus* Vandel, 1963, *Calycuoniscus* Collinge, 1915 and *Phalloniscus* Budde-Lund, 1908 and the genus *Novamundoniscus* Schultz, 1995, erected to alocate the american species of *Phalloniscus*. This study aimed to make the taxonomic review of *Novamundoniscus* and to produce phylogenetic hipotesis of monophyletic relations of the species that compound this genus, based on morphology, to elaborate a phylogenetic relationship hipotesis among the genera that compounds Dubioniscidae, redescribe known species and describe new ones. This work is presented in a single chapter, divided into two parts, taxonomy and phylogeny of *Novamundoniscus.* 18 species of *Dubioniscus*, *Novamundoniscus* e *Phalloniscus* were analysed and a data matrix with 73 characters was generated. The final tree revealed Dubioniscidae as monophiletic, but, the validity of the genus *Novamundoniscus* could not be confirmed. The results of the phylogenetic analyses presented herein are considered provisory and, the taxonomic implications of the topology discussed were not adopted in the taxonomic revision of *Novamundoniscus*. However, the optimizations of the characters in this topology furnishes important conclusions for the understanding of the evolutive history of the taxa analysed and the characters matrix offers a solid basis for the continuation of this line of research.

***Keywords*****:** Crinocheta; Phylogeny; Neotropical.

# INTRODUÇÃO

A ordem Isopoda, com mais de 10.000 espécies já descritas, inclui dez Subordens: Anthuroidea, Asellota, Calabozoidea, Cymothoidea, Flabellifera, Gnathiidea, Limmnoriidea, Microcerberidea, Oniscidea, Phoratopidea, Phreatoicidea, Sphaeromatidea, Tainisopidea e Valvifera (Poore 2005, Schmidt 2008, Wilson 2009, Taiti 2016). Representantes desta ordem podem ser encontrados nos mais variados ambientes, sobretudo aquáticos, em todos os continentes (Martin & Davis 2001).

Os isópodos terrestres (subordem Oniscidea), com mais de 3.600 espécies já descritas (Schmalfuss 2003), são os únicos representantes do sub-filo Crustacea completamente adaptados para a vida em ambiente terrestre (Sutton 1980). A água é o fator de maior influência na sobrevivência dos isópodos terrestres, sendo a manutenção do equilíbrio hídrico crucial nestes animais (Araujo 1999). Ainda que sua capacidade de conservar água seja limitada, adaptações morfofisiológicas e comportamentais permitiram aos oniscídeos colonizar os mais variados ambientes terrestres (Araujo 1994), inclusive os de clima árido, a exemplo de desertos do continente africano e Oriente Médio (Warburg et al. 1984, Ammar & Morgan 2005, Baker 2005), e nos Pampas na América do Sul (Araujo & Leistikow 1999). Com relação às adaptações morfofisiológicas, o sucesso dos isópodos terrestres na colonização de ambientes terrestres se deve à evolução no sistema de condução de água e, nas espécies mais derivadas, à presença pulmões pleopodais (Ferrara et al. 1990; Araujo & Leistikow 1999; Paoli et al. 2002). Além disso, ocorreram modificações no marsúpio, bolsa incubadora que se forma na porção ventral do pereion das fêmeas de todos os membros da superordem Peracarida (Sutton 1980), capaz de conservar água, protegendo e nutrindo os embriões, apresentando diferentes graus de complexidade entre táxons mais primitivos e derivados (Hoese 1984, Appel et al. 2011). Em Crinocheta, outra adaptação presente no marsúpio são os cotilédones, estruturas que apresentam diferentes padrões morfológicos, de distribuição e quantidades diferentes entre os táxons, responsável pela nutrição e oxigenação da prole desde o estágio de ovo até o nascimento (Appel et al. 2011). Diferente de outros crustáceos, os embriões se desenvolvem diretamente, sem estágios larvais, e os filhotes nascem semelhantes aos adultos, faltando somente o último par de pernas, que se desenvolverá nas primeiras ecdises (Brum & Araujo 2007).

Adaptações comportamentais também são imprescindíveis à sobrevivência dos isópodos terrestres, através da busca por umidade e abrigo da luz, guiados por higrorreceptores, quimiorreceptores e fotorreceptores (Holdich 1984). Outro comportamento que visa impedir a desidratação é o fenômeno da agregação. Junto com as fezes, os isópodos liberam feromônios que

atraem outros indivíduos da espécie, criando um microclima úmido, e diminuindo, assim, a taxa de perda de água para o ambiente, decorrente da transpiração (Takeda 1984).

Outras características apresentadas pelos oniscídeos que os auxiliam na sobrevivência em terra estão ligadas tanto ao comportamento quanto às características morfológicas de cada espécie. Schmalfuss (1984) classificou os isópodos terrestres em grupos ecomorfológicos, levando em consideração a estrutura corporal, utilização de habitat e estratégias antipredação. Os corredores possuem pereiópodos longos e são capazes de se locomover velozmente ao realizar fugas ou forragear em busca de alimento ou umidade. Os volvacionais são capazes de se enrolar, adquirindo forma esférica. Este comportamento é utilizado tanto para diminuir a perda de água quanto pra proteger o ventre da ação de predadores. Os espiniformes, além de capacidade volvacional, são dotados de protuberâncias no dorso que agem como espinhos. Os aderentes possuem patas curtas e robustas, além de corpo pouco convexo. Ao sinal de ameaça, aderem-se ao substrato, protegendo o ventre frágil. Os rastejantes possuem morfologia relacionada com seu modo de vida endógeo. São, em geral, menores que isópodos de outros grupos ecomorfológicos, e o dorso coberto de tubérculos evita que o animal fique preso a partículas de água. Espécies pertencentes a esse grupo possuem corpo geralmente despigmentado. Além dos grupos já citados, há aqueles que não possuem a característica de nenhum dos grupos anteriores, denominados não conformistas. Ao longo da evolução de Oniscidea, as características que definem os grupos ecomorfológicos surgiram várias vezes em diferentes táxons, evoluindo por paralelismo ou convergência. A capacidade de volvação, por exemplo, é uma sinapomorfia da família Scleropactidae (Schmidt 2007), mas pode ser encontrada em outras famílias sem ancestralidade direta, como Pudeoniscidae e Tylidae (Lemos de Castro 1973). Os aspectos funcionais da morfologia corporal do grupo dos corredores supostamente representam o estado plesiomórfico em Oniscidea, enquanto os caracteres morfológicos que definem os outros grupos evoluíram várias vezes de forma independente (Schmidt 2008).

Variados estudos sobre as interações entre os oniscídeos e o ambiente em que vivem já foram desenvolvidos. Com relação à dieta, são onívoros e alimentam-se principalmente de folhas, fungos e bactérias, podendo, ocasionalmente, se alimentar de restos de animais (Brown et al. 1978; Rushton & Hassall 1983). Além disso, realizam coprofagia, a fim de recuperar parte dos nutrientes eliminados nas fezes, sobretudo o cobre, elemento essencial à formação de hemocianina, molécula respiratória presente no sangue dos crustáceos (Hopkin & Martin 1984). Outros comportamentos alimentares já observados em oniscídeos são a predação e o canibalismo (Edney et al. 1974, Le Clec'h et al. 2013). Os isópodos possuem baixa capacidade de digestão, produzindo fezes ricas em nutrientes e estimulando, deste modo, o crescimento de microorganismos importantes na ciclagem destes nutrientes (Loureiro et al. 2006).

Nas interações entre isópodos terrestres e outros seres vivos, estes animais podem representar um papel relevante nos ambientes em que se encontram. Estes animais são fonte alimentar para inúmeros predadores, como artrópodos, répteis, aves e mamíferos (Araujo 1994). Ainda que sejam poucos os estudos sobre interações entre oniscídeos e insetos sociais, já se sabe que algumas espécies podem ser encontradas habitando ou forrageando em formigueiros (Hornung et al. 2005, Dekoninck et al. 2007) enquanto outras estão presentes em cupinzeiros (Tartally et al. 2004). Algumas espécies de oniscídeos podem forragear ou buscar abrigo em cupinzeiros (Lisboa et al. 2013) enquanto outras apresentam relações obrigatórias com os cupins, não sendo encontrados fora dos ninhos (Kensley 1971). Também são muitas as interações já observadas entre isópodos e diferentes grupos de parasitos. Dípteros da família Calliphoridae inoculam seus ovos em isópodos, sendo que a fase larval destes insetos ocorre no interior do hospedeiro (Sutton 1980). Isópodos podem ser hospedeiros intermediários de acantocéfalos, que causam alterações na coloração e no comportamento da vítima, tornando-a conspícua e vulnerável às aves que, ao predar o isópodo infectado, torna-se o hospedeiro final do parasito (Amato et al. 2003). Bactérias do gênero *Rickettsia* infestam as glândulas digestivas dos isópodos, podendo levá-los à morte (Drobne et al. 1999), enquanto as do gênero *Wolbachia* feminilizam hospedeiros machos (Braquart-Varnier et al. 2005; Verne et al. 2007).

A antropização também é um fenômeno relatado para isópodos terrestres, sendo, em alguns casos, responsável pela distribuição cosmopolita de muitas espécies (Lemos de Castro 1971; Leistikow 2000; Araujo & Taiti 2007). O grau de urbanização de determinada localidade pode afetar a diversidade de espécies de oniscídeos (Hornung et al. 2007). Algumas espécies bem adaptadas à presença humana, a maioria delas oriundas do velho mundo, foram espalhadas acidentalmente por todo o planeta, sobretudo no Neotrópico (Lemos de Castro 1971; Schmalfuss 2003) ocupando áreas antropizadas em ambiente rural e urbano (Jass & Clausmeier 2000; Vilisics et al. 2007). Leistikow & Wägele (1999), ao listar os oniscídeos que ocorrem no novo mundo, destacaram que 37 espécies presentes na lista são introduzidas, 28 delas originárias da Europa. São reconhecidas 19 espécies exóticas no Brasil (Araujo & Buckup 1996, Schmalfuss 2003), cinco delas presentes em localidades da região Amazônica, todas com ocorrência confirmada para o estado do Pará (Lemos de Castro 1967, 1971).

Por outro lado, várias espécies apresentam alto grau de endemismo, a exemplo de *Balloniscus glaber* Araujo & Zardo, 1995, com área de ocorrência limitada a áreas de Mata Atlântica do Sul do Brasil (Araujo & Zardo 1995, Bond-Buckup et al. 2003) e *Atlantoscia ituberasensis* Campos-Filho, Lisboa & Araujo, 2013, com área de ocorrência conhecida restrita a um fragmento de mata atlântica no município de Ituberá, Bahia. (Campos-Filho et al. 2013).

Algumas espécies de isópodos têm importância econômica, pois podem ser prejudiciais à agricultura. Na Austrália, *Australiodillo bifrons* Budde-Lund, 1885, espécie endêmica no país, pode atacar plantações de trigo e aveia (Paoletti et al. 2008). De acordo com Garcia & Campos (2001), no Brasil, três espécies introduzidas, *Armadillidium vulgare* (Latreille, 1804), *Porcellio laevis* Latreille, 1804 e *Porcellionides pruinosus* (Brandt, 1833) e uma espécie nativa da América do Sul, *Benthana picta* (Brandt, 1833), podem causar danos a diferentes tipos de plantas, como tomateiros, feijoeiros e orquídeas, devorando desde sementes a órgãos desenvolvidos destas plantas. Esta última também já foi relatada como praga em plantio de pimentão e ervilha (Camargo 1954).

**Filogenia de Oniscidea**

O táxon Oniscidea foi criado por Latreille em 1802. No entanto, até o final do século passado, em muitas publicações relativas à filogenia do grupo, faltava uma base metodológica confiável. A partir de Schmalfuss (1989), o monofiletismo de Oniscidea foi aceito, com base nos caracteres derivados conspícuos e comuns a todos os Oniscidea:

1- antenna I extremamente reduzida;

2- redução específica da maxila II (Figura A);

3- alterações específicas nas relações de tamanho do maxilípede (Figura B) e

4- presença de um complexo sistema condutor de água (Hoese 1981, 1982).

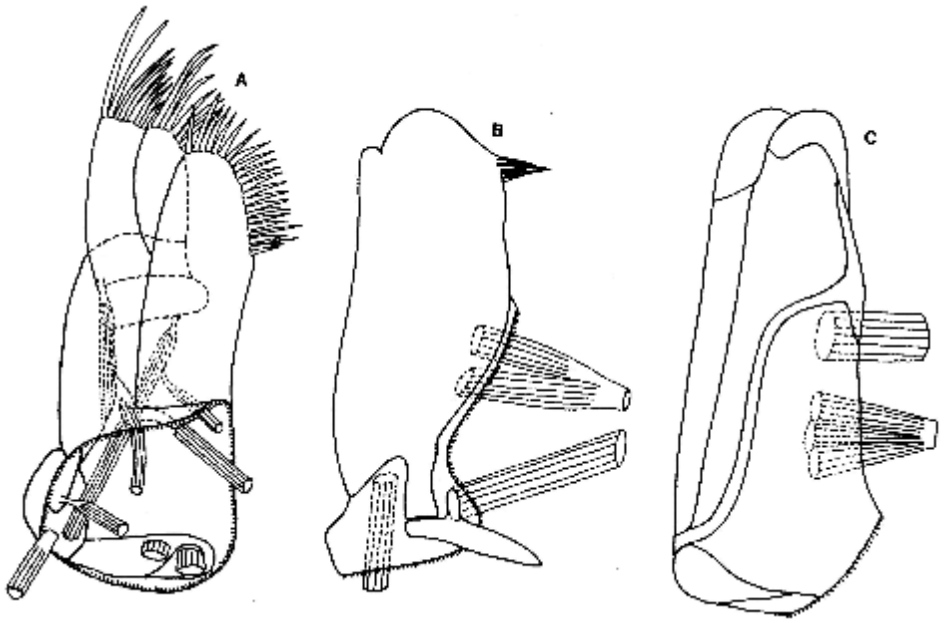


Figura A – Segunda maxílula de *Mesidotea* (A), *Ligia* (B) e *Tylos* (C), indicando uma redução específica homóloga nos dois últimos gêneros (Extraído de Schmalfuss 1989).

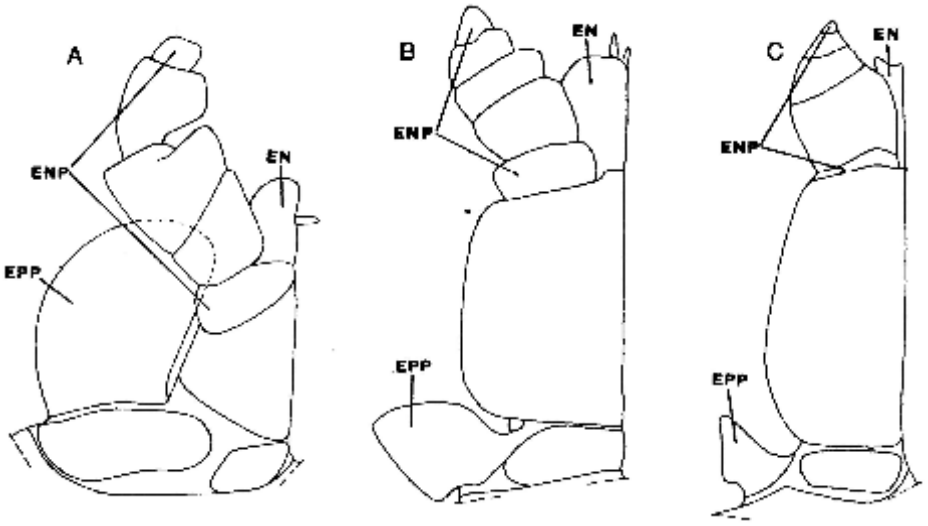


Figura B – Maxilípedes de *Mesidotea* (A), *Ligia* (B) e *Tylos* (C), alterações específicas de tamanhos derivadas nos dois últimos gêneros (redesenhado e simplificado de Schmalfuss, 1974). ENP = endopodito, EPP = epipodito, EN = endito. (Extraído de Schmalfuss 1989).

Os isópodos terrestres evoluíram de ancestrais aquáticos, através de formas viventes da zona entre - marés que adquiriram a capacidade de sobreviver por tempos cada vez mais longos fora da água (Sutton 1980). Ao longo de sua história evolutiva, à medida que foram conquistando novos ambientes, cinco linhagens surgiram (Erhard 1998, Schmidt 2008) (Figura C):

- A família Ligiidae, com cerca de 80 espécies, constituem a linhagem mais basal em Oniscidea (Schmidt 2008) e sofreram poucas adaptações para a vida em ambiente terrestre (Sutton 1980). Este gênero possui distribuição cosmopolita, mas está restrita a áreas rochosas supralitorais (Lopes et al. 2006). São os mais primitivos representantes de Oniscidea, sendo provável que os ancestrais desta subordem fossem semelhantes aos membros desta família quando iniciaram o processo de terrestrialização (Schmalfuss 1989).
- A família Tylidae possui em torno de 20 espécies costeiras e uma em ambiente terrestre, todos dotados de capacidade volvacional (Silva & Alves 2000).
- A família Mesoniscidae, com apenas dois representantes, são encontrados na Europa, nos Alpes e nos Montes Cárpatos (Schmalfuss 2003, Šustr et al. 2005).
- A seção Synocheta, a segunda linhagem em número de espécies conhecidas, possui mais de 630 espécies já descritas, a maioria adaptada à vida endógea ou em cavernas (Erhard 1998, Schmidt 2008).
- A seção Crinocheta, com mais de 2.750 espécies, representa 80% de todos os oniscídeos conhecidos (Schmalfuss 2003) (Figura D).

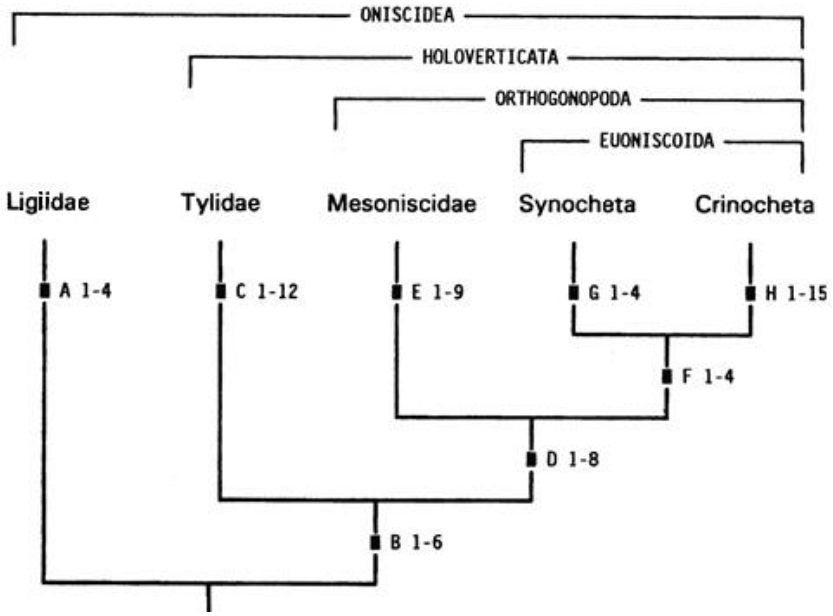


Figura C – Cladograma apresentado por Erhard (1998) para as relações em Oniscidea.

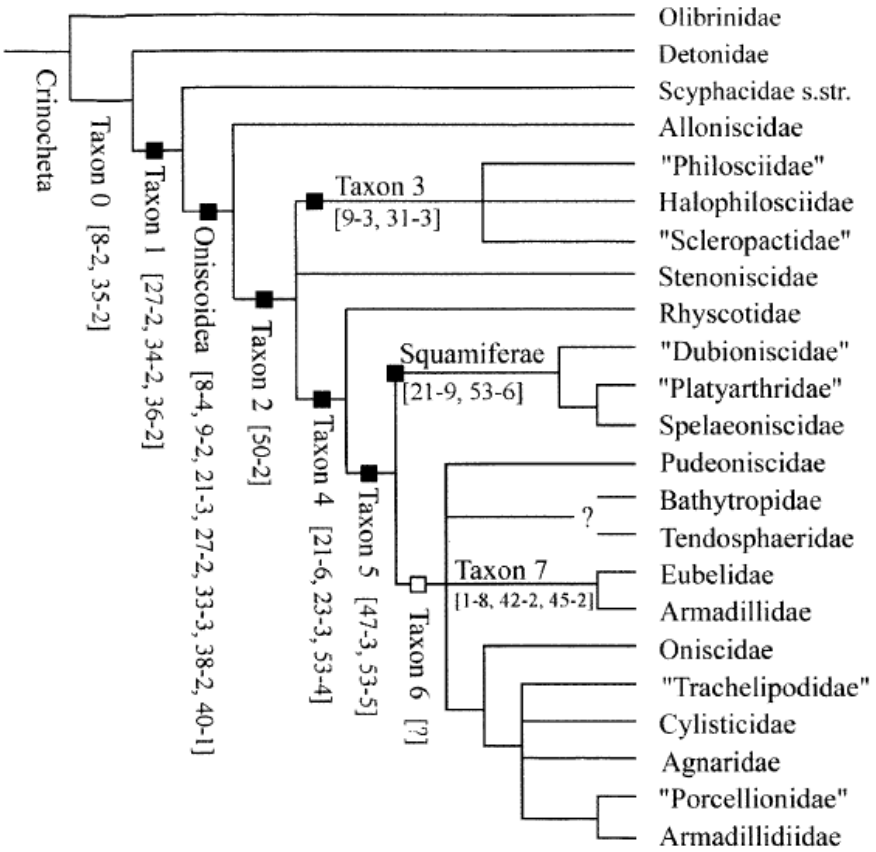


Figura D – Cladograma apresentado por Schmidt (2002) para as relações em Crinocheta.

Trabalhos filogenéticos utilizando técnicas moleculares confirmaram alguns resultados previamente obtidos através das análises morfológicas para Oniscidea (Mattern & Schlegel 2001). Mesmo assim, os relacionamentos entre os grupos de Crinocheta ainda são controversos, refletindo

interpretações alternativas em relação aos pulmões pleopodais, os quais provavelmente evoluíram independentemente em cada táxon (Mattern & Schlegel 2001, Schmidt & Wägele 2001).

Schmidt (2002) analisou a filogenia de Crinocheta e obteve as seguintes sinapomorfias para este grupo:

1- mandíbula sem molares;

2- endópodo do pleópodo 1 do macho com furo espermático;

3- redução do sistema condutor de água;

4- cotilédones e

5- tendência à formação da área respiratória na parte dorsal dos exópodos dos pleópodos.

Ao todo, 24 famílias foram classificadas como pertencentes à seção Crinocheta, entre elas a família Dubioniscidae Schultz, 1995 (Schmidt 2003), a qual atualmente abriga o gênero *Novamundoniscus*, táxon foco do presente estudo.

**Dubioniscidae**

Pertencente à seção Crinocheta, a família Dubioniscidae foi instituída por Schultz para incluir os gêneros *Dubioniscus* Vandel, 1963, *Calycuoniscus* Collinge, 1915 e *Phalloniscus* Budde-Lund, 1908, anteriormente alocados na família Bathytropidae, além do gênero *Novamundoniscus* Schultz, 1995, criado para abrigar as espécies das Américas previamente incluídas em *Phalloniscus*.

A espécie-tipo designada para esta família é *Dubioniscus delamarei* Vandel, 1963, com base em indivíduos coletados em uma floresta tropical próxima ao Rio da Prata, Argentina (Schultz 1995).

Segundo Schultz (1995), Dubioniscidae é caracterizada pelo corpo minúsculo, raramente excedendo os 6mm; antenna 1 com poucos estetascos; flagelo da antenna 2 com três estetascos; um ou mais ocelos presentes; céfalo com lobos anterolaterais bem definidos e, às vezes, apresentando uma depressão no dorso entre duas cristas laterais; molar das mandíbulas composto; maxila 1 com exópodo dotado de oito dentes quase completamente planos e endópodo sem ápice pontiagudo; dorso liso coberto com escamas minúsculas e corpo pouco ou moderadamente pigmentado (alguns em padrão marcante e outros podem ser desprovidos de pigmentação); pereiópodo I em ambos os sexos (e, em alguns casos, o pereiópodo II dos machos) dotado de aparato limpador de antenna no própodo e no carpo; pleon tão largo ou quase tão largo quanto o pereion; neopleons dos pleons 3 a 5 bem definidos dorsalmente, estendendo-se até a margem do corpo, levemente recurvado em alguns casos; exópodos dos pleópodos 1 a 5 de machos e fêmeas apresentando mesmo padrão geral; ausência de pulmão pleopodal e exópodos dos urópodos extendendo-se bem além da extremidade do pleotelson.

No entanto, na lista de características que definem esta família, Schmidt (2003) argumenta que há caracteres plesiomóficos ou "dúbios", sendo a única característica provavelmente apomórfica o exópodo da maxila 1 dotado de oito dentes.

**O gênero *Novamundoniscus***

Vandel (1962) observou que as espécies alocadas no gênero *Phalloniscus* correspondem, na verdade, a uma assembleia de espécies. Dentro desse contexto, Schultz (1995), ao criar a família Dubioniscidae, argumenta que as espécies pertencentes ao gênero *Phalloniscus* do novo mundo são, em muitos aspectos, diferentes da espécie-tipo e demais membros do gênero, encontradas, sobretudo, na Nova-Zelândia. Assim, baseado em caracteres compartilhados pelas espécies do continente americano, Schultz (1995) definiu o gênero *Novamundoniscus*. Ao todo, seis espécies anteriormente classificadas em *Phalloniscus* foram transferidas para o novo gênero e *Novamundoniscus vandeli* (Lemos de Castro 1960) foi definida como a espécie-tipo. No entanto, Schultz não transferiu todas as espécies de *Phalloniscus* do novo mundo para o gênero *Novamundoniscus*; sequer justificou tal ato (Lopes & Araujo 2003). Posteriormente, outras três espécies passaram a compor o gênero. Lopes & Araujo, 2003 descreveram *N. gracilis* e também transferiram *P. meridionalis* para o gênero *Novamundoniscus.* Posteriormente, foi descrita a espécie *N. altamiranesis* Campos-Filho, Araujo & Taiti, 2014(Campos-Filho et al. 2014). , totalizando nove espécies compondo o gênero *Novamundoniscus*:

- *Novamundoniscus vandeli* (Lemos de Castro, 1959).
- *Novamundoniscus dissimilis* (Lemos de Castro, 1959);
- *Novamundoniscus macrophthalmus* (Lemos de Castro, 1959);
- *Novamundoniscus marcuzzii* (Vandel, 1952);
- *Novamundoniscus persimilis* (Vandel, 1952);
- *Novamundoniscus singularis* (Lemos de Castro, 1967);
- *Novamundoniscus meridionalis* (Araujo & Buckup, 1994);
- *Novamundoniscus gracilis* Lopes & Araujo, 2003 e
- *Novamundoniscus altamiraensis* Campos-Filho, Araujo & Taiti, 2014.

De acordo com Schultz (1995), *Novamundoniscus* possui uma combinação de caracteres peculiares, que a distingue dos membros do gênero *Phalloniscus* da Nova Zelândia ou Europa, sendo: abdome tão largo quanto o tórax e neopleurons 3-5 bem desenvolvidos, processo molar da mandíbula composto, exópodo da maxílula com dentes regulares, endito do maxilípodo simples

com uma seta, artículo apical com setas distintas (e não com tufo de setas), setas distintas em dois grupos na margem interna do segundo artículo do palpo, artículo basal com pelo menos duas setas longas e pleópodos sem área respiratória.

Como citado anteriormente, ainda que o gênero *Novamundoniscus* tenha sido criado para alocar as espécies do gênero *Phalloniscus* do novo mundo, algumas não foram realocadas e também precisam ser revisadas, a fim de determinar se estas também pertencem a *Novamundoniscus*:

- *Phalloniscus avrilensis* (Van Name, 1940), Haiti;
- *Phalloniscus baldonii* (Arcangeli, 1930), Costa Rica: San José;
- *Phalloniscus barbouri* (Van Name, 1926), Panamá;
- *Phalloniscus langi* (Van Name, 1936), Guiana Inglesa;
- *Phalloniscus pearsei* (Van Name, 1936), Guiana Inglesa e
- *Phalloniscus setosus* Lemos de Castro, 1960, Brasil (Minas Gerais).

**Justificativa**

Devido à grande possibilidade de Dubioniscidae ser um táxon parafilético, uma discussão das afinidades entre os gêneros que atualmente compõem este grupo é obsoleta. Relações entre os gêneros (caso Dubioniscidae seja mesmo monofilético) não podem ser determinadas antes de uma redescrição das espécies envolvidas (Schmidt 2003). Assim, a fim de determinar as relações entre os táxons alocados em Dubioniscidae, é preciso realizar a revisão dos gêneros alocados nesta família. Recentemente, algumas espécies de *Dubioniscus* foram revisadas e novas espécies foram descritas (Cardoso et al. 2016). Ainda assim, as descrições originais de muitas espécies da família Dubioniscidae são antigas e pouco detalhadas, o que reforça a necessidade de uma revisão taxonômica para os demais gêneros que a compõe, além da redescrição de espécies. Além disso, o conjunto dos caracteres morfológicos utilizados para sustentar o gênero *Novamundoniscus* como um grupo monofilético é considerado insuficiente. Tais fatores enfatizam a necessidade de uma análise filogenética para a compreensão da estrutura e das relações entre as espécies pertencentes a *Novamundoniscus* e entre este gênero e demais membros da família Dubioniscidae, incluindo representantes de outras famílias de Squamiferae, tal como hipotetizado por Schmidt (2002).

Entre as oito espécies alocadas em *Novamundoniscus*, apenas *Novamundoniscus marcuzzii* (Vandel, 1952) não possui registro de ocorrência no Brasil, estando presente na Amazônia venezuelana. Das espécies brasileiras, duas estão presentes na região amazônica: *Novamundoniscus persimilis* (Vandel, 1952) – Pará e *Novamundoniscus singularis* (Lemos de Castro, 1967) – Amazonas (Schultz, 1995; Souza-Cury 1998; Schmalfuss, 2003; Lopes & Araujo, 2003). Outros

gêneros que atualmente estão alocados em Dubioniscidae também são encontrados na Amazônia Brasileira, sendo estes: *Calycuoniscus bodkini* Collinge, 1915 – Amapá e Pará, *Dubioniscus goeldii* (Lemos de Castro, 1967) – Pará e *Phalloniscus barbouri* (Van Name, 1926) – Pará.

Muitos exemplares da família Dubioniscidae com ocorrência confirmada em território brasileiro estão tombados nas coleções do Museu Nacional do Rio de Janeiro (MNRJ) e Universidade Federal do Rio Grande do Sul (UFRGS). Também há muitos lotes de oniscídeos identificados apenas como Dubioniscidae ou morfotipados como *Novamundoniscus* sp. nessas instituições e no Museu de Zoologia da Universidade de São Paulo (MUZUSP).

O trabalho de Schultz (1995), que cria a família Dubioniscidae, e os de Schmidt (2002, 2003), sobre a sistemática dos Crinocheta, trazem indícios de que o gênero *Novamundoniscus* possa, na verdade, constituir um grupo parafilético. O trabalho conduzido por Appel et al. (2011) também reforça o indício de parafiletismo, pois as duas espécies utilizadas em seu estudo (*Novamundoniscus meridionalis* e *Novamundoniscus gracilis*) apresentaram padrões diferentes dos cotilédones, o que não foi observado em outras espécies aparentadas utilizadas no estudo. A ausência de caracteres morfológicos que definem o gênero e a ausência de análises filogenéticas que forneçam evidências das relações entre as espécies de *Novamundoniscus* e dos gêneros que compõem Dubioniscidae reforça a necessidade de estudos mais aprofundados para solucionar tais questões.

## Objetivos

### Geral

Realizar a revisão taxonômica de *Novamundoniscus*, produzindo hipóteses de relacionamento filogenético entre espécies que compõem este gênero por meio de análise cladística.

### Específicos

I. Testar a hipótese de monofiletismo do gênero, estabelecendo relações de parentesco entre seus integrantes, com base em dados morfológicos.

II. Elaborar uma hipótese de relacionamento filogenético entre *Novamundoniscus* e os demais gêneros alocados na família Dubioniscidae.

III. Revisar o gênero *Novamundoniscus*, redescrevendo espécies conhecidas e descrevendo eventuais espécies novas.

IV. Confirmar e ampliar o conhecimento sobre a distribuição do gênero *Novamundoniscus*.

# MATERIAL E MÉTODOS

Exemplares de cada espécie foram estudados em estereomicroscópio para análise geral de estruturas no tegumento, ilustração do *habitus* e dissecação. Os apêndices (peças bucais – maxilípodo, maxila, maxílula, mandíbulas, antennas, antênulas, pereiópodos, pleópodos – endópodos e exópodos, urópodos e pleotélson) e montados em lâminas permanentes em meio de *Hoyer* e as ilustrações foram realizadas através de câmara lúcida. As ilustrações foram digitalizadas e digitalmente com auxílio do programa GIMP, versão 2.10.2.

Foram avaliados os caracteres presentes nas diagnoses das espécies previamente descritas. Os apêndices, como peças bucais, antennas, antênulas, pereiópodos, pleópodos, urópodos e pleotélson são os caracteres mais utilizados em análises cladísticas dos táxons de Oniscidea (Leistikow & Schmidt 2002; Schmidt 2007).

O software Mesquite versão 2.72 (Maddison & Maddison 2009) foi utilizado para a construção da matriz. As análises cladísticas foram realizadas com o software T.N.T. versão 1.1 (Goloboff et al. 2003). A árvore filogenética foi produzida com o auxílio do programa Winclada 1.00.08 (Nixon 2002).

## Área de estudo

A maioria das espécies abordadas neste trabalho ocorre na região Neotropical, em localidades do continente Americano. Há, também, espécies de ocorrência cosmopolita de da Nova Zelândia.

## Coleta de dados

Exemplares tombados em coleções científicas no Brasil e no exterior foram examinados. Os espécimes pertencem Museu Nacional do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), Coleção do Departamento de Zoologia da Universidade Federal do Rio Grande do Sul (UFRGS). Também foram analisados exemplares oriundos do Smithsonian Museum (NMNH) e do American Museum of Natural History (AMNH), ambos nos Estados Unidos da América.

# RESULTADOS E DISCUSSÃO

## Taxonomic revision and cladistic analyses of the genus *Novamundoniscus* Schultz, 1995 (Crustacea: Isopoda: Oniscidea)

### Introduction

Among crustaceans, there is an interesting group of Isopods (Malacostraca: Peracarida) called Oniscidea, whose members are, in their majority, terrestrials (Sutton 1980). They can be found inhabiting most terrestrial habitats in all continents, from sea shores to forests and deserts, except for the Antarctic Continent (Martin & Davis 2001; Schmidt 2008). Over 3,600 species were described until the moment (Schmalfuss 2003, Campos-Filho et al. 2014; Cardoso et al. 2016). The first attempts of group the Oniscidea members began in the 19$^{th}$ century, based on morphological characters (Dana 1953; Budde-Lund 1894, 1885; Dollfus 1898). However, when the phylogenetic analyses developed by Hennig (1966) were adopted by isopodologists, the relationships among the oniscideans began to become clear (Leistikow 2000, 2001; Leistikow & Schmidt 2002; Schmidt, 2002, 2008). The monophyletism of Oniscidea was confirmed through morphological data analyses (Schmalfuss 1974, 1989, Wägele 1989) and molecular data analyses (Wilson 2009; Mattern & Schlegel 2001). About 80% of the terrestrial isopods belongs to the section Crinocheta, the most derivated lineage of Oniscidea, including the family Dubioniscidae Schultz, 1995 (Schmidt 2002). However, most relationships among the 24 families of Crinocheta are still controversial (Mattern & Schlegel 2001).

The family Dubioniscidae was created by Schultz (1995) to allocate the *Dubioniscus* Vandel, 1963 and *Calycuoniscus* Collinge, 1915, previously allocated in Bathytropidae and a new genus, *Novamundoniscus* Schultz, 1995, the latter erected to allocate the American species anteriorly allocated in *Phalloniscus* Budde-Lund, 1908. However, Schmidt contests the diagnosis of Dubioniscidae, considering that only one character seems to be apomorphic, the maxillule with eight teeth. Vandel (1962) observed that *Phalloniscus* might not be monophyletic. Schultz decided to create a new family to reallocate the American species of Phalloniscus, once they present many differences if compared with New Zealand species. However, the author did not transfer all American *Phalloniscus* to the new genus with no plausible explanation (Lopes & Araujo 2003). Posteriorly, two new species were described, *N. gracilis* Lopes & Araujo, 2003, *N. altamiranesis* Campos-Filho, Araujo & Taiti, 2014 and *P, meridionalis* (Araujo & Buckup, 1994) was transferred

to *Novamundoniscus* (Lopes & Araujo 2003; Campos-Filho et al. 2014), totalizing nine species compounding the genus.

The diagnosis of the genus (Schultz 1995) and the phylogeny of Crinocheta (Schmidt 2002, 2003) indicates that *Novamundoniscus*, in fact, correspond to a paraphyletic taxon, reinforcing the necessity of reasearches to clarify the relations among the *Novamundoniscus* species and their relations with other Dubioniscidae and Crinocheta. In this context, the objective of the present study was the taxonomic revision and phylogenetic analyses of *Novamundoniscus*, necessary to comprehend such parenthetical relations.

## Material and methods

### *Material examined*

The specimens belong to Museu Nacional do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), Departamento de Zoologia da Universidade Federal do Rio Grande do Sul (UFRGS), Brazil; Smithsonian Museum (NMNH) and American Museum of Natural History (AMNH), United States of America.

### *Taxonomy*

Specimens are stored in 70–90% ethanol and the descriptions are based on morphological characters of males. The individuals were dissected and the pereonites and appendages were mounted in micropreparations. Drawings were prepared with the aid of a camera lucida. Digital illustrations were prepared with GIMP 2.8, based on Monsanto (2013). The characters analysed were those cited in literature. The *noduli laterales* were measured according to Vandel (1962). Prior descriptions and illustrations of some species present in the cladistics analyses were also used.

### *Cladistics*

A matrix with 73 characters and 25 terminal taxa was built with the aid of Mesquite 2.72 (Maddison & Maddison 2009). Description of the characters and the classification of their states as neomorphic or transformational were conducted according to Sereno (2007). Both ordered and no ordered characters (Fitch 1971) are present in the matrix. The outgroup comparison and character

polarity determination were performed as determined in Nixon and Carpenter (1993). Outgroups were composed by taxa allocated in Dubioniscidae and related taxa, according to Schmidt (2002, 2003): *Pudeoniscus birabeni* Lemos de Castro, 1973 (Pudeoniscidae) (type species), *Nagurus nanus* (Budde-Lund, 1908) (Trachelipodidae), *Phalloniscus avrilensis* (Van Name, 1940), *P. langi* (Van Name, 1936), *P. loyolai* Zardo, 1989, *P. pearsei* (Van Name, 1936), *P. punctatus* (Budde-Lund, 1912) (type species), according to Schmidt & Leistikow 2004), *Phalloniscus setosus* Lemos de Castro, 1960 (Oniscidae), *Trichorhina tomentosa* (Budde-Lund, 1893) (Plathyarthrydae), *Dubioniscus delamarei* Vandel, 1963 (type species) and *Calycuoniscus goeldii* (Lemos de Castro, 1967) (Dubioniscidae) were chosen. *Ischioscia variegata* (Dollfus, 1893) (Philosciidae) was the species selected to root the tree. The cladistics analyses were conduct with TNT 1.1 (Goloboff et al. 2003). Cladograms were built with the aid of Winclada 1.00.08 (Nixon 2002) and parcimony analyses (Nixon 2001), with implied weightening (Goloboff, 1993), based on K-values (Mirande 2009) were conducted (algorithm TBR with implied weightening in K = 3). To optimize the characters, ACCTRAN and DELTRAN methods were used, following De Pinna (1991) and Agnarsson & Miller (2008).

## Results and discussion

### *Novamundoniscus* Schultz, 1995

*Type species: Phalloniscus vandeli* Lemos de Castro, 1960, by original designation.

*Phalloniscus* Lemos de Castro, 1960;

*Novamundoniscus* Schultz, 1995; Souza–Kury, 1998; Leistikow and Wägele, 1999; Schmalfuss, 2003; Schmidt & Leistikow, 2004; Campos-Filho et al. 2014

*Diagnosis:* Tiny species, rarely exceeding 8mm. *Habitus* pigmented, oblong-oval in shape, clinger type, dorsum covered with fan-shaped scale setae. *Noduli laterales* always present, usually inserted more or less at same distance from lateral margins of epimere. Pleonites epimera 3–5 well developed and directed backwards, almost as large as the epimere of pereonite 7. Pleotelson triangular in shape, wider than long and distally acute. Cephalothorax with frontal lobe and frontal line absent, lateral lobes present, supra-antennal line present, eyes composed of 7 to 15 ommatidia, arranged in rows; antennule with three articles, bearing few asthetascs; antennae flagellum distal article longest; mandibles with 2 + 1 free penicils on left mandible and 1 + 1 on right mandible, hairy lobes densely covered by setae may be present; maxillule outer branch with 4 + 4 teeth, inner

set with cleft apex; inner branch with two penicils; maxilla outer lobe wider than inner lobe; maxilliped palp with one stout setae; endite basal article with 2 setae, distal article with set of individual setae inserted. Pereopod dactylar seta with simple apex, except for *N. macrophthalmus* (globouse apex). Uropod exopod and endopod slightly extending beyond the pleotelson. Pleopod exopods without respiratory area.

*Remarks: Novamundoniscus* differs from other genera of Dubioniscidae by distal article of antennae flagellum (vs. shortest in *Dubioniscus*; vs. fused with the medial article in *Calycuoniscus*), maxillule outer branch inner set of teeth with cleft apex (vs. teeth with simple apex in *Calycuoniscus* and *Dubioniscus*) and pleopods with no respiratory areas (vs. respiratory areas present in *Dubioniscus*).

***Novamundoniscus vandeli* (Lemos de Castro, 1960)**
(Figures 1, 2, 37A, 41).

*Phalloniscus vandeli* Lemos de Castro, 1960: 205 and 208, Figs. 1–9.
*Novamundoniscus vandeli* Schultz, 1995: 407–411, Figs. 8–9; Souza–Kury, 1998: 4; Leistikow & Wägele, 1999: 25; Schmalfuss, 2003: 159; Schmidt & Leistikow, 2004; Campos-Filho et al., 2003: 401.

*Type material examined*
*Holotype:* Brazil, State of Minas Gerais: Carmo do Rio Claro, 1 ♂, 1952, leg. J. C. M. Carvalho (MNRJ 6160).
*Allotype:* Brazil, State of Minas Gerais: Carmo do Rio Claro, 1 ♀, 1952, leg. J. C. M. Carvalho (MNRJ 6161).
*Paratypes:* Brazil, State of Minas Gerais: Carmo do Rio Claro, 14 ♂, 24 ♀, 1952, leg. J. C. M. Carvalho (MNRJ 6162). State of Rio de Janeiro: Três Rios, under fallen wood and stones, 2 ♂, 2 ♀, 1/IV/1951, leg. A. L. de Castro (MNRJ 3069).
*Additional material*: Brazil. State of Minas Gerais: Carmo do Rio Claro, 20º 58' 05" S 46º 18' 43" W, 2 ♂, 1 ♀, 18/VI/2013, leg. I. S. Campos–Filho & G. M. Cardoso (UFRGS 5716). State of Espírito Santo: Sooretama, debris on sandy soil, 1 ♂, 5 ♀, 29/X/1971, leg. A. L. de Castro & B. Prazeres (MNRJ 3095). State of Rio de Janeiro: Maricá, Itaipuaçu, 1 ♂, 4 ♀, 26/I/1950, leg. J. C. M. Carvalho (MNRJ 3132); Mangaratiba, Parada da Ribeira, in Bromeliaceae and under stones, 2 ♂, 6 ♀, 12/II/1950, leg. A. L. de Castro (MNRJ 3083); Mangaratiba, Fazenda Cachoeirinha do

Cedro (Rubião), 5 ♂, 3 ♀, 3/II/1959, leg. A. L. de Castro & A. C. S. Coelho (MNRJ 3138); Rio de Janeiro, Jacarepaguá, 5 ♂, 3 ♀, 21/XI/1978, leg. M. C. Mendonça (MNRJ 3138); Angra dos Reis, Monsuaba, epiphyte Bromeliaceae, 5 ♂, 3 ♀, 26/XI/1974, leg. A. L. de Castro & B. Prazeres (MNRJ 3130).

*Redescription*: Maximum length: ♀, 4.0 mm; ♂, 2.8 mm. Specimens depigmented due to long preservation in ethanol 70%. Color pattern as described by Lemos de Castro (1960). Body outline as in Figure 1A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with posterior corners rounded and pereonites 5–7 with posterior corners slightly directed backwards (Figure 1A). Dorsum covered with scale setae (Figure 1B); *noduli laterales* b/c and d/c coordinates as in figures 1C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 1A) well–developed and directed backwards. Pleotelson (Figure 1A) triangular, slightly concave margins and distally rounded. Cephalothorax (Figure 1A, E–F) lateral lobes small and triangular-shape, suprantennal line slightly sinuous; eyes composed of 10 ommatidia. Antennule (Figure 1H) with articles subequal in length, distal article with six aesthetascs, two subapical pairs and one pair inserted apically; antennae (Figure 1I), when extended back, reach posterior margin of pereonite 2, flagellum almost as long as fifth article of peduncle, proximal and medial articles subequal in length, distal article longest; medial article bearing one pair of aesthetascs inserted distally, distal article bearing one pair of aesthetascs inserted medially; mandibles (Figure 1J–K) with molar penicil consisting of seven to nine branches; maxillule (Figure 1L) inner branch distal margin straight and with lateral tip; maxilla (Figure 1M) outer lobe three times wider than inner lobe; maxilliped (Figure 1N) endite with distal margin slightly rounded, palp basal article setae long and subequal in length. Pereopods (Figures 2B–D) with inner claw shorter than outer claw (Figure 2C), ungual seta and dactylar seta simple, not surpassing outer claw. Uropod (Figure 2A) exopod and endopod of conical shape with sparse simple setae.

*Male:* Pereopod 1 (Figure 2B) sternal margins of merus and carpus with long setae of cleft apex, sternal and tergal margins of merus and carpus and sternal margin of propodus with setae of double–serrate apex,. Pereopod 7 (Figure 2D) with double–serrate setae. Genital papilla as in Figure 2E. Pleopod 1 exopod (Figure 2F) subrectangular, distal margin slightly sinuous, outer margin rounded; endopod (Figure 2G) more than three times longer than wide, distal portion directed outwards, outer margin with rugosities subapically. Pleopod 2 exopod (Figure 2H) triangular, outer margin concave, bearing setae; endopod (Figure 2I) elongated and slender, reaching the distal margin of pleopod 3. Pleopod 3 (Figure 2J) triangular, outer margin slightly concave, bearing setae,

distal margin with fringe of thin setae. Pleopod 4 (Figure 2K) subrectangular with a row of long simple setae on outer margin, distal margin with fringe of thin setae. Pleopod 5 (Figure 2L) subrectangular with setae on outer and inner margins.

*Remarks:* Lemos de castro (1960) described this species with eyes composed of 8 omatidia. However, all specimens examined, including the holotype, have eyes composed of 10 omatidia. *Novamundoniscus vandeli* resembles *N. dissimilis* by the eyes composed of ten ommatidia and antennule with six aesthetascs. This species differs from *N. setosus* by the absence of visible gland pores, antennule with six aesthetascs (seven in *N. setosus*), number of ommatidia (15 in *N. setosus*), mandible molar penicil consisting of up to nine setae (up to six in *N. setosus*) and pleopod 3 exopod triangular (subrectangular in *N. setosus*). Can be distinguished from *N. macrophthalmus* by the number of aesthetascs on antenna medial article (one in *N. macrophthalmus*) and presence of lateral tip on maxillule inner branch. It differs from *N. dissimilis* by the shape of genital papilla (wider in *N. dissimilis)* and shape of pleopod 1 exopod (bearing a lobe in *N. dissimilis*).

*Ecology and geographical distribution*: This species occurs in Atlantic forest of Espírito Santo, Minas Gerais and Rio de Janeiro, on the ground, under debris, or even on trees, inside epiphyte Bromeliaceae.

***Novamundoniscus marcuzzii* (Vandel, 1952)**

*Phalloniscus marcuzzii* Vandel, 1952d: 137–144; Figs. 50–56; Lemos De Castro, 1960: 204; Schultz 1995a: 407.

*Novamundoniscus marcuzzii* Leistikow & Wägele, 1999: 25; Schmalfuss, 2003: 158; Campos-Filho et al., 2003: 401.

Diagnosis and description: See Vandel (1952).

*Remarks:* The individual deposited in MNRJ (8770) was analysed and does not correspond to the referred species. The specimen is also a female, what makes difficult its identification.

*Distribution*: Venezuela.

***Novamundoniscus persimilis* (Vandel, 1952)**

*Phalloniscus persimilis* Vandel, 1952d: 144–145; Fig. 57; Lemos de Castro, 1967: 322; Schultz, 1995: 407.

*Novamundoniscus persimilis* Souza–Kury, 1998: 4; Leistikow & Wägele, 1999: 25; Schmalfuss, 2003: 158; Campos-Filho et al., 2003: 401.

*Diagnosis and description*: See Vandel (1952).

*Remarks:* Individuals deposited in MNRJ (3073) were analysed and, in fact, they correspond to *Trichorhina paraensis* Souza-Kury, 1997.

*Distribution*: Venezuela.

***Novamundoniscus dissimilis* (Lemos de Castro, 1960)**

(Figures 3, 4, 37B, 42).

*Phalloniscus dissimilis* Lemos de Castro, 1960: 207 and 211, Figs. 28–35.

*Novamundoniscus dissimilis* Schultz, 1995: 407; Souza–Kury, 1998: 4; Leistikow & Wägele, 1999: 25; Schmalfuss, 2003: 158; Campos-Filho et al., 2003: 397.

*Type material examined*

*Holotype:* Brazil, State of Rio de Janeiro: Itatiaia, Fazenda Cotrim, 1 ♂, 1951, leg. A. L. de Castro (MNRJ 6163).

*Allotype:* Same data as holotype (MNRJ 6164).

*Paratypes:* Same data as holotype (MNRJ 6165).

*Additional material*: Brazil. State of Espírito Santo: Trindade Island, 11 ♂, 23 ♀, 25/V/1950, leg. J. Alberto (MNRJ 3111). State of Rio de Janeiro: Rio de Janeiro, Jacarepaguá, Pau da Fome, in Bromeliaceae, 1 ♂, 4 ♀, 4/XII/1953, leg. R. B. Tomas (MNRJ 3128); State of Rio de Janeiro, Jacarepaguá, Represa do Camorim, 1 ♂, 3 ♀, 3/I/1948, leg. N. D. Santos (MNRJ 3081); Angra dos Reis, Mambucaba, in fallen Bromeliaceae, 9 ♂, 26 ♀, 16/XII/1974, leg. A. L. de Castro & B. Prazeres (MNRJ 3140); Rio de Janeiro, Tijuca Forest, Cascatinha, leaf sheath of Liliaceae, 3 ♂, 1 ♀, 10/VIII/1944, leg. N. D. Santos, A. Machado & E. A. Martins (MNRJ 3144); Rio de Janeiro, Quinta da Boa Vista, enviroment data unavaiable, 3 ♂, 4 ♀, 9/II/1952, leg. A. L. de Castro & J.

Becker (MNRJ 3152); Paraty, Tarituba, on moss and in leaf sheath of Bromeliaceae, 5 ♂, 14 ♀, 11/XII/1974, leg. A. L. de Castro & B. Prazeres (MNRJ 3161); Mangaratiba, Parada da Ribeira, in Bromeliaceae, 2 ♂, 3 ♀, 4/II/1959, leg. A. L. de Castro & A. C. S.Coelho (MNRJ 3163). State of São Paulo: Ubatuba, Instituto Oceanográfico, 2 ♂, 14 ♀, , 4/XII/1973, leg. A. L. de Castro & B. Prazeres (MNRJ 3108); Ubatuba, Praia Vermelha, debris on sandy soil, 4 ♂, 1 ♀,7/XII/1973, leg. A. L. de Castro & B. Prazeres (MNRJ 3108); Ilhabela, Pescadores Island, on moss, 1 ♂, 1 ♀, 26/III/1964, (MNRJ 3100); Cananéia, Castilho Island, under a cocoanut tree, 2 ♂, 6 ♀, 24/V/1969, leg. P. S. Moreira (MNRJ 3108); Santos, Ponta da Praia, under tiles and pieces of wooden boards, 1 ♂, 5 ♀, 11/IV/1963, leg. P. S. Moreira (MNRJ 3120); Ubatuba, Toninhas Beach, hidden on moss, 1 ♂, 3 ♀, 5/XII/1953, leg. A. L. de Castro & B. Prazeres (MNRJ 3151); Barueri, KM 274, in a nest of *Camponotus rufipes* (Hexapoda, Hymenoptera; Formicidae), 7 ♂, 4 ♀, 7/I/1968, leg. K.Lenko (MNRJ 3154).

*Redescription*: Maximum length: ♀, 2.7 mm; ♂, 2.2 mm. Specimen depigmented due to long preservation in ethanol 70%. Color pattern as described by Lemos de Castro (1960). Body outline as in Figure 3A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with posterior corners rounded and pereonites 5–7 with posterior corners slightly directed backwards (Figure 3A). Dorsum covered with scale setae (Figures 3B); *noduli laterales* b/c and d/c coordinates as in Figures 3C and D; gland pores not visible. Pleotelson (Figure 3A) triangular, three times longer than wider, slightly concave sides and acute apex. Cephalothorax (Figures 3A, E–F) lateral lobes small and triangular shape, suprantennal line sinuous and eyes composed of 10 ommatidia. Antennule (Figure 3H) with articles subequal in length, third article with six aesthetascs, three subapical and three inserted apically. Antennae (Figure 3I), when extended back, reach posterior margin of pereonite 2; flagellum almost as long as fifth article of peduncle, composed of three articles, with medial and distal articles subequal in length, proximal article shortest, second article bearing one aesthetasc, inserted distally and third article bearing one pair of aesthetascs, inserted distally; mandibles (Figures 3J–K) with molar penicil consisting of three to five branches; maxillule (Figure 3L) inner branch distal margin triangular; maxilla (Figure 3M) outer lobe three times wider than inner lobe; maxilliped (Figure 3N) endite rectangular with distal margin bearing some denticles. Pereopods (Figures 4B–D) with inner claw shorter than outer claw (Figure 4C), ungual and dactylar setae simple, reaching the tip of outer claw. Uropod (Figure 4A) with sparse simple setae; endopod inserted proximal to that of exopod.

*Male:* Pereopod 1 (Figure 4B) and 2 with antenna1 grooming brush covering about half of the total surface of carpus, sternal margin of merus and carpus with setae of cleft apex; sternal and tergal margins of merus and carpus with setae of trifurcate apex ; sternal margin of carpus sensorial spine seta with double–serrate apex inserted posteriorly. Pereopod 7 (Figure 4D), with the same type of setae seen on pereopod 1. Genital papilla as in Figure 4E. Pleopod 1 exopod (Figure 4F) rounded, with a lobe on distal margin and sparce simple setae on inner margin; endopod (Figure 4G) three times longer than wider, with spike-like denticles on outer margin distally. The apex of endopod 1 is slightly bent outwards. Pleopod 2 exopod (Figure 4H) triangular, outer margin concave, bearing setae; endopod (Figure 4I) reaching the distal margin of pleopod exopod 2. Pleopod 3 (Figure 4J) subrectangular, outer margin slightly concave, with setae inserted on inner and outer margins. Pleopod 4 (Figure 4K) subrectangular with setae as seen on pleopod 3. Pleopod 5 (Figure 4L) triangular, setae as seen on pleopods 3 and 4.

*Remarks:* Lemos de Castro (1960) described the eyes composed of about 8 omatidia. However, all specimens examined, including the holotype, have 10 omatidia. *Novamundoniscus dissimilis* resembles *N. vandeli* by the number of ommatidia (ten), number of aesthetascs on antennule (six), *N. vandeli* and *N. macrophthalmus* by the number of aesthetascs on antenna second article (one). It is readily distinguishable from other species by the shape of the apex of the cleft setae on pereopods 1 and 7 of male, genital papilla enlarged, presence of lobe on pleopod 1 exopod and the presence of spike–like denticles on endopod of pleopod one. This species differs from *N. vandeli* by the presence of supraantennal line.

*Ecology and geographical distribution: N. dissimilis* occurs in forests, beach and urban areas of Espírito Santo, Rio de Janeiro and São Paulo, inhabiting moss, litter, leaf sheaths of Liliaceae and Bromeliaceae and inside ant nests. Lemos de Castro (1960) refers to the individuals present in Trindade Archipel, 1,200 Km far from the Brazilian coast, as a recent invasion.

***Novamundoniscus macrophtalmus* (Lemos de Castro, 1960)**

(Figures 5, 6, 37C, 43).

*Phalloniscus macrophtalmus* Lemos de Castro, 1960: 205 and 209, Figs. 20–27.

*Novamundoniscus macrophtalmus* Schultz, 1995: 407, Figs. 8–9; Souza–Kury, 1998: 3; Leistikow & Wägele, 1999: 25. Schmalfuss, 2003: 158; Campos-Filho et al., 2003: 397.

*Type material examined*

*Holotype:* Brazil, State of Rio de Janeiro state: Macaé, Barra do Sana, 1 ♂, I/957, leg. L. de Castro (MNRJ 6157).

*Allotype:* 1 ♀, Same data as holotype (MNRJ 6158).

*Paratypes:* 3 ♂,6 ♀, Same data as holotype (MNRJ 6159).

*Redescription:* Maximum length: ♀, 4.5 mm ♂, 3.0 mm. Specimens depigmented due to long preservation in ethanol 70%. Color pattern as described by Lemos de Castro (1960). Body outline as in Figure 5–A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–5 with posterior corners rounded and pereonites 6–7 with posterior corners slightly directed backwards. Dorsum covered with scale setae (Figure 5B); *noduli laterales* b/c and d/c coordinates as in Figures 5C and D; gland pores not visible. Pleonites epimera 3–5 well developed and directed backwards. Pleotelson triangular (Figure 5A). Cephalothorax (Figures 5A, E–F) lateral lobes small and triangular-shape, suprantennal line slightly sinuous; eyes very big and conspicuous with 13 ommatidia; antennule (Figure 5H) with proximal and distal articles subequal in length, medial article smallest, distal article bearing four aesthetascs, one subapical pair and one apical pair; antennae (Figure 5I), when extended back, reach posterior margin of pereonite 1, fifth article of peduncle slightly longer than flagellum, flagellum proximal article smallest, medial and distal articles subequal in length; medial article bearing one aesthetasc inserted medially and third article bearing a pair of aesthetascs inserted near the proximally; mandibles (Figures 5J–K) with molar penicil consisting of seven branches; maxillule (Figure 5L) inner branch distal margin conical; maxilla (Figure 1M) with bilobate apex; outer lobe three times wider than inner lobe; maxilliped (Figure 5N) basis rectangular, with sparse simple setae; endite with distal margin slightly rounded, palp basal article with two long setae. Pereopods (Figure 6 B, C–D) with inner claw as long as outer claw, ungual seta of globose tip as long as outer claw and dactylar seta simple as long as outer claw (Figure 6C). Uropod (Figure 6A) endopod enlarged on basis, bearing one stout sensilla on tip and inner margin bearing a tuft of long and thin setae.

*Male:* Pereopod 1 (Figure 6B) sternal margin of merus, carpus and propodus with double-serrate setae and sternal margin of carpus with setae of cleft apex, carpus with a handlike seta inserted on sternal margin. Pereopod 7 (Figure 6D) carpus with double-serrate setae on sternal margin. Genital papilla as in Figure 6E. Pleopod 1 exopod (Figure 6F) subrectangular; endopod (Figure 6G) more than three times longer than large, distal portion bent outwards, a longitudinal row of setae medially. Pleopod 2 exopod (Figure 6H) triangular, outer margin concave, inner and outer margins

bearing setae; endopod (Figure 6I) elongated and slender, slightly surpassing the anterior margin of pleopod, bearing a row of setae medially on outer margin. Pleopod 3 (Figure 6J) subrectangular, outer margin slightly concave, inner and outer margins bearing setae and with a tuft of setae on the distal margin. Pleopod 4 (Figure 6K) subrectangular with outer margin slightly concave, setae as seen on pleopod 3. Pleopod 5 (Figure 6L) triangular, setae as seen on pleopods 3 and 4.

*Remarks: Novamundoniscus macrophthalmus* resembles *N. vandeli* by the number of aesthetascs on antenna second article (one) and *N. dissimilis* by the presence of cleft setae of on male pereopod one. *N. macrophtalmus* is readily distinguishable from the other species by the big eyes and omatidia and by the lack of pigmentation on pereonite 2.

*Ecology and geographical distribution*: *N. macrophthalmus* was collected in Rio de Janeiro, but no ecological information about this species or collecting site is available.

***Novamundoniscus setosus* Lemos de Castro, 1960 n. comb**

(Figures 7, 8, 37C, 42)

*Phalloniscus setosus* Lemos de Castro, 1960: 207 and 210, Figs. 20–27; Souza-Kury, 1998: 4; Leistikow & Wägele, 1999: 26; Schmalfuss, 2003: 179.
*Phalloniscus meridionalis* Araujo & Buckup, 1994: 271–274, Figs. 14–27; Souza-Kury, 1998: 4; Leistikow & Wägele, 1999: 25; Schmalfuss, 2003: 179.
*Novamundoniscus meridionalis* Lopes & Araujo, 2003: 611.

*Type material examined*

*Holotype:* Brazil, State of Minas Gerais: Vespasiano, 1 ♂, X/1953, A. L. de Castro (MNRJ 6166). *Paratype:* 1♂, same data as holotype (MNRJ6167); Conceição de Aparecida, Haras Raiz Mineira, 21°05'S, 46°12'W, 1 ♂, 2 ♀ 12/VI/2013, leg. G.M. Cardoso & I.S. Campos-Filho (UFRGS 5711); Conceição de Aparecida, near a coffee plantation, 21°05'S, 46°12'W, 1 ♂, 1 ♀ 12/VI/2013, leg. G.M. Cardoso & I.S. Campos-Filho (UFRGS 5717); Areado, 21º25'S, 46º09'W, coffee plantation near Furnas Dam, 2 ♂, 2 ♀, 11/VI/2013, leg. G.M. Cardoso & I.S. Campos-Filho (UFRGS 5707); Campanha, 21º49'S, 45º23'W, ciliary forest, in the woods, under the bark of a fig tree, 1 ♂, 7/VI/2013, leg. G.M. Cardoso & I.S. Campos-Filho (UFRGS 5611). State of Santa Catarina: São Lourenço do Oeste, underleaves, stones and bricks, 2 ♀, 20/I/1991, leg. P. B. Araujo (UFRGS

1769); Mondaí, under decaying leaves of an avocado tree, 1 ♂, 7 ♀, 20/I/1991, leg. P. B. Araujo (UFRGS 1767); Seara, forest near Fritz Plaumann Museum, under leaves, 12 ♂, 16 ♀, 5 juveniles, 23/I/1991, leg. P. B. Araujo (UFRGS 1768). Concórdia, 1 ♂, 4 ♀,1/XII/2003, leg. N. Beber (UFRGS 4693). State of Rio Grande do Sul: Iraí, near Balneário Municipal, in the woods, 2 ♀, 22/I/1991, leg. P. B. Araujo (UFRGS 1762); Derrubadas, Parque estadual do Turvo, under leaves and wood, 1 ♂, 7 ♀, 21/I/1991, leg. P. B. Araujo (UFRGS 1764); São Luiz Gonzaga, litter in the woods near a road, 2 ♀,4/II/1991, leg. P. B. Araujo (UFRGS 1765); São Borja, under leaves, 6 ♂, 15 ♀, 4/II/1991, leg. P. B. Araujo (UFRGS 1763); Estrela, under decaying leaves and wood, 3 ♂, 7 ♀, 1/II/1991, leg. P. B. Araujo (UFRGS 1761).

*Redescription*: Maximum length: ♀, 5,1mm; ♂, 3,7 mm. Color pattern as described by Araujo & Buckup (1994) Body outline as in Figure 7A. Pereonite 1 with anterior corners slightly directed frontwards, epimeres 2-4 round, epimeres 5–7 slightly directed backwards (Figure 7A). Dorsum covered with scale setae (Figure 7B); *nodule laterales* b/c and d/c coordinates as in Figures 7C–D; anterolateral margins of pereonite 1 with six gland pores. Pleonites epimera 3–5 (Figure 7A) directed backwards. Pleotelson (Figure 7A) triangular with slightly concave margins. Cephalothorax (Figures 7A, E–F) lateral lobes triangular-shape, suprantennal line sinuous and eyes composed of 15 ommatidia. Antennule (Figure 7H) with proximal and distal aticles subequal in length, medial article smaller, distal article with seven aesthetascs. Antenna (Figure 7I), when extended back, reach posterior margin of pereonite 2; flagellum shorter than the fifth article of peduncle, proximal article shortest in length and distal article longest, medial article bearing one pair of aesthetascs reaching distal margin of the article distal article bearing one pair of aesthetascs inserted distally; mandibles (Figures 7J–K) with molar penicil consisting of of five to six branches, pars intermedia bearing minute setae; maxillule (Figure 7L) inner branch distal margin straight; maxilla (Figure 7M) outer lobe three times wider than inner lobe; maxilliped (Figure 7N) endite with distal margin straight and bearing denticles, palp basal article outer setae shortest. Pereopods (Figures 8B–D) with inner claw shorter than outer claw, ungual seta and dactylar seta simple, not surpassing outer claw. Uropod (Figure 8A) exopod and endopod of conical shape.

*Male:* Pereopod 1 (Figure 8B) sternal margin of merus and carpus with setae of cleft apex and some setae of double–serrate apex, sternal margin of propodus with setae of double–serrate apex, ornamentary sensory seta of carpus double-serrate with cleft apex. Pereopod 7 (Figure 8D), with setae of double–serrate apex. Genital papilla as in Figure 8E. Pleopod 1 exopod (Figure 8F) triangular, distal margin bearing minute setae; endopod (Figure 8G) with a longitudinal row of setae

inserted medially and a longitudinal row of setae inserted subapically. Pleopod 2 (Figure 2H) exopod triangular, outer margin concave, bearing setae; endopod (Figure 2I) elongated and slender, reaching the distal margin of pleopod 3. Pleopod 3 (Figure 8J) subrectangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 8K) rectangular, with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 8L) triangular, with setae as seen on pleopods 3 and 4.

*Remarks: Novamundoniscus meridionalis* Lopes & Araujo, 2003, is a junior synonym of *P. setotus*. Lopes & Araujo (2003) described this species with four gland pores, but, in this re-description, six pores could be found in every individual analysed. The number of ommatidia of *N. meridionalis* is up to 12. But, up to 15 ommatidia could be found on bigger individuals. Based on general characteristics of *P. setosus* that resembles *Novamundoniscus,* we suggest to realocate *P. setosus* in this genus. *Novamundoniscus setosus* is readily distinguishable from the other species of *Novamundoniscus* by the number of antennule aesthetascs (seven), presence of gland pores on pereonite 1 and by the unique shape of pleopod endopod 1. This species can be distinguished from *N. vandeli* by the number of ommatidia (vs. 10 in *N. vandeli*), presence of setae inserted apically on pleopod 1 endopod, from *N. macrophthalmus* by the size of ommatidia field, row of setae on outer margin of outer endite of maxillule (continuous and longer in *N. macrophthalmus*) and from *N. dissimilis* by the shape of pereopod 1 ornamentary sensory seta of simple apex on carpus 1 of *N. dissimilis*).

*Ecology and geographical distribution*: *Novamundoniscus setosus* was recorded in the states of Minas Gerais, Santa Catarina and Rio Grande do Sul, on coffee plantations, cilliary forest, in the woods, under barks of trees, leaves and wood.

***Ischioscia singularis* (Lemos de Castro, 1967) n. comb.**

(Figures 9, 10, 45).

*Phalloniscus singularis* Lemos de Castro, 1967: 321–322; Lemos de Castro, 1970: 119–120, Figs. 1–11;

*Novamundoniscus singularis* Souza-Kury, 1998: 4; Schmalfuss, 2003: 159; Campos-Filho et al., 2003: 401.

*Type material examined*

Holotype: Brazil, State of Amazonas: Ducke Biological Reserve, Manaus, under the bark of a fallen trunk, 1 ♂, 28/XI/1961, leg. R. Arlé (MNRJ 6168). Allotype: same data as holotype, 1 ♀, (MNRJ 6169). Paratype: same data as holotype, 1 ♀, (MNRJ 6170).

Additional material examined: State of Amazonas: Ducke Biological Reserve, Manaus. 1 ♂, 30/VII/1971, leg. J. B. Britaki. (MNRJ 3061).

*Redescription:* Maximum length: ♀, 3.1 mm; ♂, 2.3 mm. Specimens depigmented due to long preservation in ethanol 70%. Color pattern as described by Lemos de Castro (1967, 1970d). Body outline as in Figure 9A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with posterior corners rounded, pereonites 5–7 directed backwards (Figure 9A); dorsum covered with fan shape scale setae (Figure 9B); *noduli laterales* absent; gland pores not visible. Pleonites epimera 3–5 (Figure 9A), directed backwards. Pleotelson (Figure 9A) triangular with slightly concave margins. Cephalothorax (Figures 9A, C and D) lateral lobes triangular-shape, frontal line straight and suprantennal line slightly sinuous, eyes composed of 15 ommatidia and laterally protruding, exhibiting a T-shape in frontal view; antennule (Figure 9F) articles subequal in length, proximal article with a shield-like protrusion, distal article with seven aesthetascs inserted in tuft; antenna (Figure 9G) when extended back, reach posterior margin of pereonite 2; flagellum shorter than fifth article of peduncle, proximal and medial articles subequal in length, distal article longest, medial article bearing two aesthetascs inserted distally, distal article with three aesthetascs inserted medially, apical organ long, bearing a pair of sensillae inserted subapically and tuft of long free sensillae inserted distally; mandibles (Figures 9H–I) molar penicil consisting of five to eight branches and bearing coniform setae; maxillule (Figure 9J) outer branch with 5 + 5 cleft teeth and one pair of small setae inserted subapically; inner branch distal margin rounded; maxilla (Figure 9K) inner lobe about 1 1/2 wider than outer lobe; maxilliped (Figure 9L) endite distal margin rounded, densely covered by setae, palp basal article outer seta smaller; second article with setae inserted individually. Pereopods (Figures 8B–D) with inner claw shorter than outer claw, ungual seta with simple apex reaching the tip of inner claw, dactylar seta plumouse reaching the tip of outer claw. Uropod (Figure 10A) exopod and endopod subequal in length. Pleopods (Figures 10F-L) with no respiratory areas.

*Male:* Pereopods 1 (Figure 10B) and 2 sternal margin of merus, carpus and propodus with setae of trifid apex, sternal margin of ischium and tergal margin of carpus with tuft of simple setae, carpus ornamental sensory seta with hand-like apex. Pereopod 7 (Figure 10D), with setae as seen on

pereopods one and two and tergal margin of ischium with tuft of setae inserted. Genital papilla as in Figure 10E. Pleopod 1 exopod (Figure 10F) subrectangular; endopod (Figures 10G) with longitudinal row of setae inserted distally and inner margin with subapical hook. Pleopod 2 exopod (Figure 10H) triangular, bearing setae on inner margin, outer margin concave; endopod (Figure 10I) reaching the proximal margin of pleopod 3. Pleopod 3 (Figure 10J) subrectangular, bearing setae. Pleopod 4 (Figure 10K) subrectangular, setae as seen on pleopod 3. Pleopod 5 (Figure 10L) triangular, setae as seen on pleopods 3 and 4.

*Remarks:* After the description of *Phalloniscus singularis* (Lemos de Castro, 1967) a complementary description was published (Lemos de Castro 1970). But, although the author observed that this species shares characters with *Ischioscia* species, like the protruding eyes in T-shape in frontal view and the maxilliped aspect, he did not transfer *P. singularis* to this genus. After re-examination of the type material of *P. singularis,* it could be observed that this species resembles members of *Ischioscia* by the runner-type shape of *habitus* and pereopods length, which becomes longer from 1 to 7, abstence of *noduli laterales*, protruding eyes in T-shape in frontal view and presence of scale field on pereopods. This species resembles *I. panamensis I. hanagarth and I. stenocarpa, I. sturmi* by the presence of both *linea frontalis and linea supraantennalis*. Resembles *I. colorata, I. trifasciata* and *I. bolivari* by the plumouse dactylar seta, *I. variegata, I. marmorata, I. pariae, I. hirsuta, I. colorata, I. quadrispinis, I. panamensis, I. guamae, I. trifasciata, I. mineri, I. fasciifrons, I. elongata, I. muelleri, I. plurimaculata, I. martinae, I. cadoangelis, I. bolivari* and *I. curvaculeus*, by the presence of a subapical hook on pleopod 1 endopod. It differs from the Dubioniscidae genera by the *habitus* runner-type shape (vs. clinger-type in Dubioniscidae), pereopod dactylus ungual seta plumouse (vs. simple apex in Dubioniscidae) presence of trifid setae on pereopods, maxillule outer branch with 5 + 5 cleft teeth (vs. 4+4 in Dubioniscidae) antennae lateral tip with lateral sensillae (vs absent in Dubioniscidae)We suggest to realocate *N. singularis* in the genus *Ischioscia*.

*Ecology and geographical distribution*: *I. singularis* was collected in Ducke biological reserve, Amazonas, in the Amazon Rain forest, under the bark of fallen trunks (Lemos de Castro 1967, 1970). *Ischioscia* species occurs in the Neotropics, present from northwestern South America and Central America north to Guatemala (Lemos de Castro, 1955; Schmalfuss, 1980; Leistikow 1997, 2000; Leistikow and Schmidt, 2002).

***Dubioniscus gracilis* Lopes & Araujo, 2003 n. comb.**

(Figures 11, 12, 38A, 46).

*Novamundoniscus gracilis* Lopes & Araujo, 2003: 611, Figs. 1–20; Campos-Filho et al., 2003: 401.

*Type material re–examined*

*Paratypes:* Brazil, State of Rio Grande do Sul: São Francisco de Paula, 29°17'S, 50°15'W, Araucaria pine tree Forest, in the litter, 1 ♂, 1 ♀, 19/XI/1999, leg. E. R. C. Lopes, P. B.Araujo & G. Bond-Buckup (UFRGS 3618); Torres, Itapeva, 29°21'S, 49°44'W, dune vegetation, in the litter, 4 ♂, 11 ♀, 10/XI/1998, leg. E. R. C. Lopes, P. B. Araujo, & G. Bond-Buckup (UFRGS 3622); Torres, Itapeva, 29°38'S, 49°78'W, restinga vegetation, in the litter, 2 ♂, 9/XII/1998, leg. E. R. C. Lopes (UFRGS 3621); Tainhas, 29°32'S, 50°17'W, Araucaria pine tree Forest, in the litter, 1♀, 19/XI//1999, leg. E. R. C. Lopes (UFRGS 3619); Tainhas, 29°32'S, 50°20'W, Araucaria pine tree Forest, in the litter, 2 ♂, 2 ♀, 6/XI/1998, leg. E. R. C. Lopes (UFRGS 3623); Tainhas, 29°32'S, 50°41'W, Araucaria pine tree Forest, in the litter, 1♂, 26/XII/1998, leg. E. R. C. Lopes, A. O. Almeida & L. R. Bernardi. (UFRGS 3620); São Francisco de Paula, 29°32'S, 50°48'W, Araucaria pine tree Forest, in the litter, 1 ♀, 6/XI/1998, leg. E. R. C. Lopes, M. M. Gralla & T. S. Castro. (UFRGS 3624); Arroio do Sal, 29°35'S, 49°50'W, restinga vegetation, in the litter, 1 ♂, 3/III/1999, leg. E. R. C. Lopes (UFRGS 3625); Arroio do Sal, 29°33'S, 49°55'W, restinga vegetation, in the litter, 1 ♂, 1 ♀, 25/IX/1999, leg. E. R. C. Lopes (UFRGS 3629); Arroio do Sal, 29°53'S, 49°51'W, restinga vegetation, in the litter, 2 ♂, 4 ♀, 9/XII/1998, leg. E. R. C. Lopes & A. A. P. Bueno (UFRGS 3626); Arroio do Sal, 29°36'S, 49°53'W, restinga vegetation, in the litter, 11 ♂, 20 ♀, 9/XII/1998, leg. E. R. C. Lopes & A. A. P. Bueno (UFRGS 3627); Arroio do Sal, 29°36'S, 49°53'W, restinga vegetation, in the litter, 4 ♂, 1 ♀, 25/IX/1999, leg. E. R. C. Lopes (UFRGS 3628); Capão da Canoa, 29°49'S, 50°04'W, restinga vegetation, in the litter, 4 ♂, 14 ♀, 7/IV/2003, leg. E. R. C. Lopes, P. B. Araujo, & G. Bond-Buckup (UFRGS 3632); Capão da Canoa, 29°51'S, 50°07'W, in dry fallen leaves of Bromeliaceae, 1 ♂, 1 ♀, 10/XI/1998, leg. E. R. C. Lopes P. B. Araujo, & G. Bond-Buckup (UFRGS 3630); Capão da Canoa, 29°53'S, 51°06'W, restinga vegetation, in the litter, 10 ♂, 24 ♀, 10/XI/1998, leg. E. R. C. Lopes P. B. Araujo, & G. Bond-Buckup (UFRGS 3631).

*Additional material*: Brazil. State of Paraná: Morretes, 25°28'S, 48°51'W, 1 ♂, 1/XII/2013, leg. I. S. Campos-Filho & G. M. Cardoso (UFRGS 5940). State of Santa Catarina: Florianópolis: Praia do Forte, 27°26'S, 48°31'W, many ♂ and ♀, 4/III/2005, leg. P. B. Araujo (UFRGS 4087); Praia do Forte, 27°26'S, 48°31'W, many ♂ and ♀, 4/III/2005, leg. P. B. Araujo (UFRGS 4088) Praia dos

Ingleses, many ♂ and ♀, 23/X/2004, leg. A. F. Quadros (UFRGS 4097); Praia dos Ingleses, 27°26'S, 48°31'W, in the woods, litter and umid sandy soil, many ♂ and ♀, 5/II/2005, leg. M. P. Almerão (UFRGS 3805); Praia Daniela, 27°27'S, 48°32'W, many ♂ and ♀, 4/III/2005, leg. P. B. Araujo (UFRGS 4089); Parque do Rio Vermelho, 27°33'S, 48°26'W, many ♂ and ♀, 8/II/2005, leg. M. P. Almerão (UFRGS 3818); Morro da Lagoa, 27°36'S, 48° 28'W, in the litter, many ♂ and ♀ 7/II/2005, leg. M. P. Almerão (UFRGS 3811); Lagoa do Peri, 27°44'S, 48°30'W, trail near Lagoa do Peri, dry litter and sand, many ♂ and ♀, 5/II/2005, leg. M. P. Almerão (UFRGS 3802); Praia da Solidão, 27°47'S, 48°32'W, in the litter, near a house, many ♂ and ♀, 6/II/2005, leg. M. P. Almerão (UFRGS 3809).

*Redescription:* Maximum length: ♀, 4.2 mm; ♂, 3.6 mm. Body outline as in Figure 11A. Color pattern as described by Lopes & Araujo (2003). Body outline as in Figure 11A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–6 with corners rounded and pleonite 7 with corners slightly directed backwards (Figure 11A). Dorsum covered with scale setae (Figure 11B); *noduli laterales* b/c and d/c coordinates as in figures 11C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 11A) directed backwards. Pleotelson (Figure 11A) triangular, slightly concave margins and acute apex. Cephalothorax (Figures 11A, E–F) with anterior margin rounded, lateral lobes triangular shape, suprantennal line absent, eyes composed of 15 ommatidia; antennule (Figure H) with proximal and distal articles subequal in length, medial article shortest, distal article with six aesthetascs, two pairs inserted medially and one pair inserted apically; antennae (Figure I), when extended back, reach posterior margin of pereonite 3; flagellum 2/3 the length of the fifth article of peduncle, composed three articles, medial article the longest, distal article very short; medial article bearing one pair of aesthetascs, inserted subapically and third article with one aesthetasc, inserted medially; mandibles (Figures 11J–K) with molar penicil consisting of six to nine branches; maxillule (Figure 11L) inner branch distal margin rounded and with lateral tip; maxilla (Figure 11M) outer lobe four times wider than inner lobe; maxilliped (Figure 11N) endite with distal margin straight and bearing two denticles, medial seta stout and without penicil; palp basal article with two long setae. . Pereopods (Figures 12B, F–G) with inner claw shorter than outer claw, ungual and dactylar setae of simple apex almost reaching the tip of outer claw. Uropod (Figure 12A) exopod twice longer than endopod; endopod inserted proximally.

*Male:* Pereopod 1 (Figure 12B) sternal margin carpus with with setae of cleft apex; sternal margin of carpus with one seta of double–serrate apex inserted posteriorly, sternal margin of propodus with two setae of double–serrate apex inserted medial-posteriorly. Pereopod 7 (Figure 12D), sternal

margin of ischium with long and slender setae. Genital papilla as in Figure 12E. Pleopod 1 exopod (Figure 12F) triangular, inner margin rounded and outer margin concave; endopod (Figures 12G–H) with a longitudinal row of individual setae inserted medially and a longitudinal row of minute setae inserted subapically (Figure 12H). Pleopod 2 exopod (Figure 12I) triangular, outer margin concave, bearing setae, endopod (Figure 12J) reaching the distal margin of pleopod 5. Pleopod 3 (Figure 12K) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 12L) rectangular, setae inserted as seen on pleopod 3. Pleopod 5 (Figure 12M) triangular, setae inserted as seen on pleopods 3 and 4.

*Remarks:* The genus *Dubioniscus* was revised by Cardoso et al. (2016). *This species* is readily distinguishable from *Novamundoniscus* species by the inner teeth of maxillule of simple apex and distal article of antenna 2 shorter than the second article. According to the supracited characters, this species must be realocated in the genus *Dubioniscus.*

*Ecology and geographical distribution: Novamundoniscus gracilis* was collected in Paraná, Santa Catarina and Rio grande do Sul, in Atlantic forest ecosystems, like Araucaria pine tree Forest, litter, dune vegetation, restinga vegetation, in dry fallen leaves of Bromeliaceae, dry litter and sand and near houses.

***Novamundoniscus altamiraensis* Campos-Filho, Araujo & Taiti, 2014**

*Diagnosis and description*: See Campos-Filho et al. (2014).

*Novamundoniscus altamiraensis* Campos-Filho et al., 2003: 397–401, Figs. 26–28.

*Distribution*: Altamira, Pará, Brazil.

***Novamundoniscus* sp. 1**

(Figures 13, 14, 38B, 47).

*Type material examined*

*Holotype:* Brazil, State of Bahia: Una, Fazenda Ararauna, 15°18'S, 39°09'W, in canopy Bromeliaceae 1 ♂, 29/X/2013, leg. W. da Rocha (UFRGS 6384).

*Paratypes:* Brazil, State of Bahia: Floresta Azul, Ribeirão Limoeiro, 14°50'S, 39°40'W, in litter and moss 4 ♂, 9 ♀, 1VIII/2008, leg. J. T. Lisboa (UFRGS 6388); Ilhéus, Comissão Executiva para o Plano da Lavoura Cacaueira (CEPLAC), 14°45'S, 39°13'W, in *Nasutitermes* sp. nest, 1 ♂, 2 ♀, 2007, leg. P. P. S. Santos (UFRGS 6393); Ilhéus, Comissão Executiva para o Plano da Lavoura Cacaueira (CEPLAC), 14°45'S, 39°13'W, on litter 1 ♂, Campos-Filho, I. S.; Lisboa, J. T. (UFRGS 6394); Ilhéus, Universidade Estadual de Santa Cruz, 14°47'S, 39°10'W, under the bark of a cocoa nut tree branch. 1 ♂, I/2014, J. T. Lisboa (UFRGS 6389); Itabuna, BR - 101, 14°52'S, 39°16'W, in litter 4 ♂, 16 ♀, 19/IX/2013, leg. I. S. Campos-Filho & J. T. Lisboa (UFRGS 6387); Itapé, 14°59'S, 39°31'W, under the bark of trunks and branches 2 ♂, 9 ♀, 18/IX/2013, leg. I. S. Campos-Filho & J. T. Lisboa (UFRGS 6390); Same data as holotype, 6 ♂, 16 ♀ (UFRGS 6385); Same data as holotype, 12 ♂, 20 ♀ (UFRGS 6386); Same data as holotype, 5 ♂, 10 ♀ (MPEG 9880); Canavieiras, 15°39'S, 38°57'W, in the litter 1 ♂, 2 ♀, 21/XII/2009, leg. J. T. Lisboa (UFRGS 6391); Nova Viçosa, 17°54'S, 39°22'W, on the litter, near the beach 1 ♂, 1 ♀, I/2013, L. Buckup & G. Bond-Buckup (UFRGS 6392). Brazil, State of Espírito Santo: Linhares, Bairro Canivete, enviroment data unavaiable 1 ♂, 1 ♀, 28/X/1971, leg. A. Lemos de Castro & B. Prazeres (MNRJ 3096).

*Description:* Maximum length: ♀, 2.5 mm; ♂, 2.3 mm. Body outline as in Figure 13A. Color: *habitus* with five brown longitudinal bands, one on each epimera, a medial one and two alternated with four yellowish bands, inner bands oval in shape; cephalothorax brown with yellowish spots; antennae, pereopods and uropods unpigmented. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–6 with round margins, pleonite 7 directed backwards (Figure 13A); dorsum covered with scale setae (Figures 13B, G); *noduli laterales* b/c and d/c coordinates as in figures 13C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 13A), directed backwards. Pleotelson (Figure 13A) triangular with straight margins and distally rounded. Cephalothorax (Figures 13A, E–F) lateral lobes small and triangular shape, suprantennal line slightly sinuous, eyes composed of 10 ommatidia. Antennule (Figure H) with proximal article longest, medial article smallest, distal article with six aesthetascs, two subapical pairs and one pair

inserted apically. Antennae (Figure I) when extended back, reach posterior margin of pereonite 2; flagellum shorter than fifth article of peduncle, proximal article shortest, medial and distal articles subequal in length; medial article bearing one aesthetasc inserted distally, distal article with two aesthetascs inserted medially; mandibles (Figures 13J–K) with molar penicil consisting of five to six branches; maxillule (Figure 13L) inner branch distal margin triangular; maxilla (Figure 13M) outer lobe two times wider than inner lobe; maxilliped (Figure 13N) endite with distal margin straight, frontal face of endite with setae inserted in tuft; palp basal article outer seta smallest. Pereopods (Figures 10B–D) with inner claw shorter than outer claw (Figures 10C), ungual seta of simple apex, slightly surpassing the tip of outer claw and dactylar setae of simple apex, not reaching the tip of outer claw. Uropod (Figure 14A) bearing sparse simple setae, some stout and long, endopod inserted proximally. *Male:* Pereopod 1 (Figure 14B) sternal and tergal margins of merus and carpus and sternal margin of propodus with setae of double–serrate apex. Pereopod 7 (Figure 14D) sternal margin of ischium with fringe of long and thin setae, dorsal and sternal margins of ischium and merus and sternal margin of propodus with simple setae. Genital papilla as in Figure 14E. Pleopod 1 exopod (Figure 14F) triangular, distal margin with lobe and outer margin concave; endopod (Figure 14G) inner margin with one longitudinal row of individual setae inserted subapically. Pleopod 2 exopod (Figure 14H) triangular, outer margin concave, bearing setae, endopod (Figure 14I) reaching the distal margin of pleopod 2. Pleopod 3 (Figure 14K) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 14L) rectangular with setae inserted as seen on pleopod 3 and with minute setae on inner margin and distally. Pleopod 5 (Figure 14M) triangular with setae on both inner and outer margins.

*Remarks:* This species resembles *N. dissimilis and N. vandeli* by the number of ommatidia (ten), number of aesthetascs on antennule (six), *N. vandeli and N. macrophthalmus* by the number of aesthetascs on medial article of antenna. (one). *Novamundoniscus* sp. can be distinguished from other species *of the genus* by the presence of a lobe of unique shape on pleopod 1 exopod..

*Ecology and geographical distribution: Novamundoniscus* sp. 1 was collected in southern Bahia and Espírito Santo, in cocoa nut agrosystems and in Atlantic Forest, under tree barks, fallen trunks, moss and in the litter. They are also present on canopies, inhabiting epiphyte Bromeliaceae and in vegetation in the littoral zone.

***Novamundoniscus* sp. 2**

(Figures 15, 16, 38C, 48).

*Type material examined*

*Holotype:* Brazil. State of Bahia: Salvador, in the litter 1 ♂, V/2007, leg. J. T. Lisboa (UFRGS 4461).

*Paratypes:* Brazil. State of Paraíba: Cajazeiras, in floating aquatic plants "baronesa" 3 ♂, 6 ♀, 01/VIII/1986, leg. A. L. de Castro (MNRJ 3116).

*Description:* Maximum length: ♀, 3.3 mm; ♂, 2.7 mm. Body outline as in Figure 15A. Color: cephalothorax and *habitus* yellowish brown, with sparce light brown spots, epimeres, antennae, pereopods and uropods unpigmented. Body outline as in Figure 15A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–5 with round corners, pereonites 6–7 directed backwards (Figure 15A). Dorsum covered with scale setae (Figures 15B); *noduli laterales* (Figure 15G), b/c and d/c coordinates as in figures 15C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 15A), directed backwards. Pleotelson (Figure 15A) triangular, slightly concave margins and distally rounded. Cephalothorax (Figures 15A, E–F) lateral lobes small and round shape, suprantennal line slightly sinuous, eyes composed of 7 ommatidia. Antennule (Figure 15H) with proximal article smallest, medial and distal articles subequal in length, distal article with six aesthetascs, two subapical pairs and a pair inserted apically; antennae (Figure 15I) when extended back, reach posterior margin of pereonite 2; flagellum shorter than fifth article of peduncle, proximal article shortest, distal article longest; medial article bearing one aesthetasc, inserted distally and distal article with two aesthetascs, inserted medially; mandibles (Figures 15J–K) with molar penicil consisting of four to six branches; maxillule (Figure 15L) inner branch with distal margin rounded; maxilla (Figure 15M) outer lobe about two times wider than inner lobe; maxilliped (Figure 15N) basis rectangular, with sparse simple setae, frontal face of endite with a tuft of setae in *sulcus marginales*, endite distal margin straight, palp basal article outer seta smallest. Pereopods (Figures 16B–D) with inner claw as long as the outer claw, ungual setae simple, slightly surpassing outer claw, dactylar setae simple, not surpassing outer claw. Uropod (Figure 16A) endopod inserted proximally.

*Male:* Pereopod 1 (Figure 16B) sternal and tergal margins of merus and carpus and sternal margin of propodus with setae of double–serrate apex,, sternal margin of carpus with a row of setae of cleft apex. Pereopod 7 (Figure 16D), sternal and tergal margins of ischium, merus and carpus and sternal

margin of propodus with setae of double–serrate apex. Genital papilla as in Figure 16E. Pleopod 1 exopod (Figure 16F) elipzoidal; endopod (Figure 16G) with a longitudinal row of setae inserted subapically on inner margin. Pleopod 2 exopod (Figure 16H) triangular, outer margin concave, bearing setae, endopod (Figure 16I) surpassing the distal margin of pleopod 2. Pleopod 3 (Figure 16K) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 16L) rectangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 16M) triangular, with setae inserted on inner and outer margins.

*Remarks: Novamundoniscus* sp. 2 resembles *N. dissimilis* and *N. macrophthalmus* by the presence of cleft apex setae on carpus 1. Differs from other species of *Novamundoniscus* (except for *Novamundoniscus* sp.3) by the number of aesthetascs on antenna 1 (five) and by the elipzoidal shape of pleopod 1 exopod. Although some other species of the genus also bears a tuft of setae in sulcus marginales, its position is unique in *Novamundoniscus* sp. 2.

*Ecology and geographical distribution: Novamundoniscus* sp. 2. occurs in Atlantic forest of Bahia and Paraíba, in aquatic plants and the litter.

***Novamundoniscus* sp. 3**

(Figures 17, 18, 38D, 49).

*Type material examined*

*Holotype:* Brazil, State of Rio de Janeiro: Itatiaia, Parque Estadual do Itatiaia, 22°25'S, 44°37'W, 1 ♂, 9/VI/2013, leg. G. M. Cardoso & I. S. Campos-Filho (UFRGS 6480).

*Paratypes:* Brazil, State of Rio de Janeiro: 1 ♂, 2 ♀, same data as holotype (UFRGS 6481). Nova Iguaçu, Represa Boa Esperança, Tingua, 14/05/1955 (MNRJ3105).

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*Description:* Maximum length: ♀, 3.5 mm; ♂, 2.9 mm. Color: brown median area of the pereonites yellowish, antennae peduncle brown and flagellum yellowish, uropods brown, cephalothorax brown with irregular yellowish spots, pleotelson brown. Body outline as in Figure 17A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with corners rounded, pereonites 5–7 with posterior corners directed backwards (Figure 17A); dorsum covered with scale setae (Figures 17B, G); gland pores not visible; *noduli laterales* (Figure 17G), b/c and d/c coordinates as in figures 17C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 17A), directed backwards.

Pleotelson (Figure 17A) triangular with straight margins and triangular apex. Cephalothorax (Figures 17A, E–F) lateral lobes small and round-shape, suprantennal line sinuous, eyes composed of 8 ommatidia; antennule (Figure H) with second article shortest, proximal and distal articles subequal in length, distal article with five aesthetascs one aesthetasc inserted proximally, one subapical pair and an apical pair; antennae (Figure 17I) when extended back, reach posterior margin of pereonite 1; flagellum shorter than fifth article of peduncle, proximal article longest; medial and distal articles subequal in length, medial article bearing one aesthetasc reaching distal margin of the article and distal article with two aesthetascs reaching distal margin of the article; mandibles (Figures 17J–K) with molar penicil consisting of four to six branches; maxillule (Figure 17L) inner branch distal margin triangular; maxilla (Figure 17M) outer lobe about two times wider than inner lobe; maxilliped (Figure 17N) endite distal margin straight and bearing two denticles and bearing minute setae, palp basal article with outer seta smallest. Pereopods (Figures 18B–D) with inner claw (Figure 18C) vestigial, ungual and dactylar setae of simple apex reaching the tip of outer claw. Uropod (Figure 18A) bearing sparce simple setae, exopod twice longer than endopod; endopod inserted proximally.

*Male:* Pereopod 1 (Figure 18B) sternal margin of merus and propodus and sternal and tergal margins of carpus with long setae of double–serrate apex. Pereopod 7 (Figure 18D), without any sexual modifications. Genital papilla as in Figure 18E. Pleopod 1 exopod (Figure 18F) rounded; endopod (Figure 18G) about three times longer than wider. Pleopod 2 exopod (Figure 18H) triangular, outer margin concave, bearing setae, endopod (Figure 18I) surpassing the anterior margin of pereonite 5. Pleopod 3 (Figure 18J) rectangular, outer margin slightly concave, bearing setae, inner margin with a tuft of long simple setae. Pleopod 4 (Figure 18K) rectangular, outer margin straight, with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 18L) trapezoidal, inner and outer margins bearing fringes of setae .

*Remarks: Novamundoniscus sp.* 3. sp. resembles *N. dissimilis* by the vestigial inner claw of dactyus, *N. dissimilis and N. macrophthalmus* by the dactylar seta as long as dactylus outer claw. Differs from other *Novamundoniscus* species by the maxilliped with pilouse palp.

*Ecology and geographical distribution: Novamundoniscus sp.* 3. was collected in atlantic forest, in Itatiaia Ecological Reserve, Rio de Janeiro.

***Novamundoniscus* sp. 4**

(Figures 19, 20, 39A, 50).

*Type material examined*

*Holotype:* Brazil, State of Ceará: near margin of Orós Weir, 6°14'S, 39°55'W, 1 ♂, 04/IV/2011, leg. I. S. Campos-Filho (UFRGS 6406). *Paratypes:* 4 ♂; 14 ♀, same data as holotype (UFRGS 6407).

*Description:* Maximum length: ♀, 4.8 mm; ♂, 4.3 mm. Color: three longitudinal bands brown on pereonites and pleotelson, a medial one and two on epimera, alternated with two yellowish bands on paramedian portion; cephalothorax brown with yellowish spots, antennae peduncle pigmented, flagellum unpigmented, uropods brown. Body outline as in Figure 19A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with posterior corners rounded, 5–7 directed backwards (Figure 19A). Dorsum covered with scale setae (Figures 19B, G); *noduli laterales* b/c and d/c coordinates as in figures 19C and D; gland pores present on anterior margin of pereonite 1. Pleonites epimera 3–5 (Figure 19A) directed backwards. Pleotelson (Figure 19A) triangular with slightly concave margins and round apex. Cephalothorax (Figures 19A, E–F) anterior margin round, lateral lobes small and triangular-shape, suprantennal line slightly sinous; eyes composed of 16 ommatidia; antennule (Figure 19H) with proximal and distal articles subequal in length, medial article shortest, distal article with eight aesthetascs, two rows of three aesthetascs and one apical pair; antennae (Figure 19I) when extended back, reach posterior margin of pereonite 3; flagellum shorter than fifth article of peduncle, proximal and medial article subequal in size, distal article longest; second article bearing one pair of aesthetascs reaching distal margin of the article, distal article bearing one pair of aesthetascs inserted medially; mandibles (Figures 19J–K) with molar penicil consisting of ten to twelve branches; maxillule (Figure 19L) inner branch distal margin rounded and with lateral tip; maxilla (Figure 19M) outer lobe two times wider than inner lobe; maxilliped (Figure 19N) endite with distal margin straight, palp basal article outer seta smallest. Pereopods (Figures 20B–D) with inner claw shorter than outer claw, ungual and dactylar setae of simple apex not surpassing outer claw. Uropod (Figure 20A) exopod about 1 ½ longer than endopod.

*Male:* Pereopods 1 (Figure 20B) and 2 sternal margin of merus and carpus with long setae of cleft apex and long setae of simple apex, sternal and tergal margins of carpus and sternal margin of propodus with setae of double–serrate apex ,, pereopod 1 ornamentory sensory seta double-serrate

with cleft apex inserted almost distally. Pereopod 7 (Figure 20D), with double-serrate setae inserted on tergal margins of ischium, merus and carpus and on sternal margin of carpus and propodus. Genital papilla as in figure 20E. Pleopod 1 exopod (Figure 20F) subrectangular, outer margin bearing setae, endopod (Figure 20G) about three times longer than wide. Pleopod 2 exopod (Figure 20H) triangular, outer margin concave, bearing setae, endopod (Figure 20I) slightly surpassing the anterior margin of pleopod 3. Pleopod 3 (Figure 20K) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 20L) rectangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 20M) triangular, with setae inserted as seen on pleopods 3 and 4.

*Remarks: Novamundoniscus* sp. resembles *N. gracilis* and *N. vandeli* by the presence of lateral tip on inner endite of maxillule, N. *altamiraensis* and *N. gracilis* by the shape of pleotelson and *N. vandeli* by the presence of both simple and cleft long setae on pereopods 1 and 2. It can be distinguished from the other species of *Novamundoniscus* by the number of aesthetascs of antennule (five) and by the number of ommatidia (vs. 7 in *N. dissimilis* ; vs. 8 in *N. vandeli*, vs. 13 in *N. macrophthalmus*, vs. 15 in *N. altamiraensis*).

*Ecology and geographical distribution: Novamundoniscus* sp.**4** was collected near Orós weir, built almost 60 years ago to provide more water to this semi-arid region, making the Jaguaribe river perennial (DNOCS 2017).

***Novamundoniscus* sp. 5**

(Figures 21, 22, 39B, 51).

*Type material examined:*

*Holotype:* Paraguay, Neembucuru: Villa del Pilar, near Paraguay river, in litter, 26°52’S, 58°18’W, 1 ♂, 04/IV/2011, leg. G. A Schultz (NMNH267280). *Paratypes:* 4 ♂; 14 ♀, same data as holotype.

*Description:* Maximum length: ♀, 3.2 mm; ♂, 2.5 mm. Body outline as in figureColor pattern as described by Schultz (1995). Body outline as in Figure 21A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–4 with posterior corners rounded and pereonites 5–7 with posterior corners directed backwards (Figure 21A). Dorsum covered with scale setae (Figures 21B–G); *noduli laterales* b/c and d/c coordinates as in Figures 21C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 21A), directed backwards. Pleotelson (Figure 21A) triangular with

slightly concave margins and round apex. Cephalothorax (Figures 21A, E–F) anterior margin rounded, lateral lobes small and triangular-shape, suprantennal line straight; eyes composed of 11 ommatidia; antennule (Figure H) with articles subequal in length, third article with six aesthetascs, two subapical pairs and one pair inserted apically; antennae (Figure 21I), when extended back, reach posterior margin of pereonite 3; flagellum shorter than fifth article of peduncle, proximal and medial article subequal in size, distal article longest; medial article bearing two aesthetascs inserted distally and third article with two aesthetascs inserted medially; mandibles (Figures 21J–K) with molar penicil consisting of ten to twelve branches, right mandible bearing free simple setae; maxillule (Figure 21L) inner branch with distal margin rounded; maxilla (Figure 21M) outer lobe about 1 1/2 wider than inner lobe; maxilliped (Figure 21N) endite with distal margin straight, palp basal article outer seta smallest. Pereopods (Figures 22B–D) with inner claw as long as outer claw, ungual seta and dactylar seta of simple apex reaching the tip of outer claw. Uropod (Figure 22A) exopod about 1 ½ longer than endopod.

*Male:* Pereopods 1 (Figure 22B) and 2 sternal margin of merus and carpus with setae of cleft apex, sternal and tergal margins of ischium, merus and carpus and sternal margin of propodus with setae of double–serrate apex. Pereopod 7 (Figure 22D), with double-serrate setae. Genital papilla as in Figure 22E. Pleopod 1 exopod (Figure 22F) subrectangular, endopod (Figure 22G) about three times longer than wide, with a longitudinal row of individual setae inserted medially and a longitudinal row of small setae inserted subapically. Pleopod 2 exopod (Figure 22H) triangular, outer margin concave, bearing setae, endopod (Figure 22I) slightly surpassing the anterior margin of pleopod 5. Pleopod 3 (Figure 22K) triangular, outer margin slightly concave, bearing some setae. Pleopod 4 (Figure 22L) subrectangular, bearing simple setae on outer margin and a fringe of minute setae on distal margin. Pleopod 5 (Figure 22M) subrectangular, setae as seen on pleopod 3.

*Remarks: Novamundoniscus* sp. 5 resembles *N. vandeli* and *N. dissimilis* by the number of aesthetascs of antennule (6), *N. macrophthalmus, N. vandeli* and *N. dissimilis* by the presence of cleft setae on male pereopod 1 and N. *altamiraensis* by the shape of pleotelson. It can be distinguished from other species, except for *N. altamiraensis*, by the number of ommatidia: (vs. 7 in *N. dissimilis*, vs. 8 in *N. vandeli*, vs 13 in *N. macrophthalmus*).

*Ecology and geographical distribution: Novamundoniscus* sp. 5 was collected in Paraguay, province of Neembucuru, near Paraguay river, in litter of primary and gallery tropical forests, inhabiting moderately moist leaf litter and organic detritus.

***Novamundoniscus* sp. 6**

(Figures 23, 24, 39C, 52).

*Type material examined:*

*Holotype:* Brazil, State of Espírito Santo: Fundão, in litter, 21° 55'S, 40° 24'W, 1 ♂, 04/V/20216, (UFRGS 6995). *Paratypes:* 6 ♂; 10 ♀, same data as holotype (UFRGS 6996).

*Description:* Maximum length: ♀, 2.2 mm; ♂, 2.5 mm. Body outline as in figureColor: brown, with yellowish spots on the paramedical region, antennae peduncle brown with yellowish flagellum and uropods brown in dorsal view and yellowish in ventral view, cephalothorax brown with yellowish spots . Body outline as in Figure 23A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–6 with posterior margins rounded and pereonite 7 directed backwards (Figure 23A); dorsum covered with scale setae (Figures 23B, G); n*oduli laterales* b/c and d/c coordinates as in Figures 23C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 23A), directed backwards. Pleotelson (Figure 23A) triangular, slightly concave margins and round apex. Cephalothorax (Figures 23A, E–F) anterior margin rounded, lateral lobes small and triangular-shape, suprantennal line straight; eyes composed of 11 ommatidia; antennule (Figure 23H) with proximal and distal articles subequal in length, medial article smallest, distal article with six aesthetascs, two subapical pairs and one pair inserted apically. Antennae (Figure 23I) when extended back, reach posterior margin of pereonite 2, flagellum shorter than fifth article of peduncle, medial and distal article subequal in size, proximal article smallest, second article bearing one pair of aesthetascs reaching the distal margin of the article and distal article bearing one pair of aesthetascs, inserted medially; mandibles (Figures 23J–K) with molar penicil consisting of four to seven branches; maxillule (Figure 23L) inner branch distal margin triangular and with lateral tip; maxilla (Figure 23M) outer lobe about two times wider than inner lobe; maxilliped (Figure 23N) endite basal article outer seta smallest. Pereopods (Figures 24B–D) with inner claw as long as outer claw, ungual seta and dactylar seta of simple apex reaching the tip of outer claw. Uropod (Figure 24A) exopod about 1 ½ longer than endopod.

*Male:* Pereopods 1 (Figure 24B)sternal margin of merus, carpus and propodus with setae of double–serrate apex. Pereopod 7 (Figure 24D), with double-serrate setae as seen on pereopod 1. Genital papilla as in Figure 24E. Pleopod 1 exopod (Figure 24F) subrectangular, endopod (Figure 24G) proximally enlarged . Pleopod 2 exopod (Figure 24H) triangular, outer margin concave, bearing setae, endopod (Figure 24I) slightly surpassing the anterior margin of pleopod 3. Pleopod 3 (Figure

24K) triangular, outer margin slightly concave, bearing minute setae on distal margin. Pleopod 4 (Figure 24L) subrectangular, outer margin concave, bearing setae on outer margin and a fringe of minute setae on distal margin. Pleopod 5 (Figure 24M) subrectangular, setae as seen on pleopod 3.
*Remarks: Novamundoniscus* sp. 6 resembles *N. vandeli* (Lemos de Castro, 1960) and *N. dissimilis* (Lemos de Castro, 1960) by the number of aesthetascs of antennule (six), It resembles *N. altamiraensis* Campos-Filho, Araujo & Taiti, 2214 by the number of ommatidia. This species differs from some other *Novamundoniscus* species by the number of ommatidia: (vs. 7 in *N. dissimilis*; vs. 8 in *N. vandeli* and vs 13 in *N. macrophthalmus*) and by the shape of pleopod 1 endopod.

*Ecology and geographical distribution: Novamundoniscus* sp. 6 was recorded in Atlantic Forest in Espírito santo, in the litter.

**Family Dubioniscidae**

***Calycuoniscus* Collinge, 1915**

*Type species: Calycuoniscus ambiguus* (Budde-Lund, 1893).

*Diagnosis and description:* See Collinge (1915).

*Distribution*: The Americas.

***Calycuoniscus goeldii* (Lemos de Castro, 1967)**

(Figures 25, 26, 39D, 51).

*Hyleioniscus goeldii* Lemos de Castro, 1967: 318
*Calycuoniscus goeldii* Lemos de Castro, 1968: 407-411 (figs), Cardoso et al., 2016: 3.
*Dubioniscus goeldii* Schultz, 1995: 401. Souza-Kury, 1998: 4; Schmalfuss, 2003: 92.

*Type material*
*Holotype:* Brazil, State of Pará: Belém, 1 ♂, Pq Zoobotânico do Museu Paraense Emílio Goeldi, III-IV.1965, leg. R. Arlé & H. Schubart (MNRJ 6203).
*Allotype:* Brazil, State of Pará: Belém, 1 ♀, same data as holotype (MNRJ 6204).

*Paratypes:* Brazil, State of Pará: Belém, 10 ♂; 6 ♀, same data as holotype (MNRJ 6205).
*Additional material*: State of Pará: Altamira: 1 ♀, Abrigo do Paratizão, 3° 15′ 03″S, 52° 01′ 57″W, 12 .XI.2009, leg. M.E. Bichuette (UFRGS 5377); Abrigos Assurini, 3° 15′ 02″S, 52° 12′ 31″W, 15.XII.2010, leg. M.E. Bichuette and J.E. Gallão (UFRGS 5378); Canaã dos Carajás, Gruta S11-07, 06° 27′ 20″S, 50° 14′ 29″W, 3–19.VIII.2010, leg. R. Andrade (UFRGS 4778), Parauapebas, Gruta Cave 24 S11, 06° 25′ 21″S, 50° 18′ 24″W, 22–28.IX.2010, leg. R. Andrade (UFRGS 4753); Parauapebas, Gruta Cave 34 S11, 06° 24′ 40″S, 50°20′35″W, 22–28.IV.2010, leg. R. Andrade (UFRGS 4774), Altamira, Abrigo do Sismógrafo, 03° 17′ 18″S, 52° 13′ 30″W, 12.XI.2009, leg. M.E. Bichuette (UFRGS 4752).

*Redescription:* Maximum length: ♀, 4.5 mm; ♂, 2.5 mm. Color pattern as described by Lemos de Castro (1960). Body outline as in Figure 25A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–5 with posterior corners rounded and pereonites 5–7 with posterior corners slightly directed backwards (Figure 25A); *noduli laterales* b/c and d/c coordinates as in figures 25C and D; gland pores not visible. Pleonites epimera 3–5 well–developed and directed backwards. Pleotelson (Fig 25A) triangular, slightly concave sides and distallly rounded. Cephalothorax (Figures 25A, D–E) with lateral lobes well developed and triangular-shape, frontal line and suprantennal line slightly sinuous; eyes composed of 10 ommatidia; antennule (Figure 25H) proximal article longer, medial and distal articles subequal in size, distal article with four aesthetascs, one subapical pair and one pair inserted apically; antennae (Figure 25I) when extended back, reach posterior margin of pereonite 1, flagellum almost as long as the fifth article of peduncle; proximal article the shortest, medial and distal article almost completely fused and delimited by an incomplete suture, third article bearing a single aesthetasc inserted medially and one pair of aesthetascs inserted distally; mandibles (Figures 25J–K) with molar penicil consisting of four to five branches; maxillule (Figure 25L) outer branch with 4 + 4 simple teeth, inner branch distal margin triangular; maxilla (Figure 25M) outer lobe three times longer than inner lobe; maxilliped (Figure 25N) endite with distal margin straight and a small lobe on distal margin, palp basal article with outer seta smallest. Pereopods (Figures 26B–D) with inner claw as long as outer claw, ungual setae of simple apex, not surpassing outer claw and dactylar seta of simple apex slightly surpassing outer claw (Figure 26C). Uropod (Figure 26A) exopod and endopod subequal in length and conical-shape.

*Male:* Pereopod 1 (Figure 26B) sternal and tergal margins of merus and carpus and sternal margin propodus with setae of double-serrate apex. Pereopod 7 (Figure 26D) with double-serrate setae.

Genital papilla (Figure 26E) as in figure 26E. Pleopod 1 (Figure 26F) exopod of subrectangular, endopod (Figure 26G) more than three times longer than large, outer margin concave with a row of longitudinal setae inserted distally. Pleopod 2 (Figure 26H) exopod triangular, outer margin concave, bearing simple setae; endopod surpassing the proximal margin of pleopod 5 (Figure 26I). Pleopod 3 (Figure 26J) subrectangular, outer margin slightly concave, bearing simple setae on inner and outer margins. Pleopod 4 (Figure 26K) rectangular with minute setae inserted on inner and outer margins. Pleopod 5 (Figure 26L) triangular with setae inserted as seen on pleopod 4.

*Remarks:* Cardoso et al. (2016) transferred this species from *Calycuoniscus* to *Dubioniscus.* However, *Calycuoniscus goeldii* differs from other species of the *Dubionniscus* by the absence respiratory areas and by the fusion of articles 2 and 3 of antenna, common to all *Calycuoniscus*. A revision of the genus *Calycuoniscus* is necessary to define the relationships of this species among others of the family Dubioniscidae.

**Family Oniscidae**

***Phalloniscus* Budde-Lund, 1908**

*Type species: Phalloniscus punctatus* (Thompson, 1879), by subsequent designation (Budde-Lund, 1908).

*Oniscus* Thompson, 1879.

*Phalloniscus* Budde-Lund, 1908; Wahrberg, 1922; Chilton, 1925; Verhoeff, 1926; Stephensen, 1927; Bowley, 1935; Hurley, 1950; Vandel, 1952; Lemos de Castro, 1960; Lemos de Castro, 1967; Lemos de Castro, 1970; Araujo & Buckup, 1994; Schultz, 1995; Taiti & Ferrara, 1996; Souza–Kury, 1998; Leistikow & Wägele, 1999; Green *et al*. 2002: 43; Lopes & Araujo, 2003; Schmalfuss, 2003; Leistikow & Schmidt, 2004.

*Diagnosis: Habitus* oblong-oval in shape, dorsum covered with trichorn scale setae. Pleonites epimera 3–5 well developed and directed backwards. Pleotelson triangular in shape, wider than longer and distally rounded. Cephalothorax with frontal lobe and lateral lobes present, frontal line present, sometimes interrupted in the middle, supra-antennal line present, eyes composed of numerous ommatidia (over 15); Antennule with three articles, bearing numerous asthetascs,

antennae flagellum with three articles, distal article longest; mandibles with 2 + 1 free penicils on the left mandible and 1 + 1 on the right mandible, hairy lobes densely covered by setae; maxillule outer branch with 4 + 5 or 4 + 6 simple teeth; inner branch with two penicils, lateral tip may be present; maxilla outer lobe wider than inner lobe; maxilliped palp bearing, three stout setae; endite basal article with 2 setae, distal article with setae inserted as a tuft. Dactylar seta with simple apex. Uropod exopod and endopod slightly surpassing pleotelson. Pleopods exopods without respiratory areas.

*Remarks:* Budde-Lund (1908) erected the genus *Phalloniscus* to allocate two species of *Oniscus* from New Zealand, *O. punctatus* and *O. kenepurensis* (Chilton, 1901). A full review of this genus to clarify the relationships among them (Vandel, 1962; Schultz, 1995) is necessary. The genus *Phalloniscus* is probably endemic to New Zealand (Vandel 1977, Taiti & Ferrara 1996).

*Distribution:* New Zealand and the Americas.

***Phalloniscus punctatus* (Thompson, 1879)**
(Figures 27, 28, 40A, 54).

*Oniscus punctatus* Thompson, 1879: 232 and 247, pl. X, fig. A3; Budde-Lund, 1885: 206; Filhol, 1885: 440; Thompson & Chilton, 1886: 158; Chilton, 1901: 133, pl. XVI, fig. 2; Chilton, 1906: 273; Chilton, 1909: 668; Chilton, 1910: 288.
*Phalloniscus punctatus* Budde-Lund, 1908: 296; Wahrberg, 1922: 91; Chilton, 1925: 319; Verhoeff, 1926: 331; Stephensen, 1927: 372; Bowley, 1935: 46, pl. V, figs 20-25; Hurley, 1950: 122; Taiti & Ferrara, 1996; Green *et al*. 2002: 43; Schmalfuss, 2003: 179; Leistikow & Schmidt, 2004: 70.

*Material examined:*
New Zealand: South Island, Otago, Dunedin. 1 ♂, 3 ♀ leg. C. Chilton (NMNH 18936).

*Redescription:* Maximum length: ♀, 8.5 mm; ♂, 5.8 mm. Specimens depigmented due to long preservation in ethanol 70%. Color pattern as described by Thompson (1879). Body outline as in Figure 27A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1-3 with round posterior corners, 4–7 directed backwards (Figure 27A); dorsum covered with trichorn setae (Figures 27B–E); *noduli laterales* absent; gland pores present. Pleonites epimera 3–5 (Figure 27A)

directed backwards. Pleotelson (Figure 27A) triangular with straight margins and round apex. Cephalothorax (Figures 27A, C–D) lateral lobes small and round-shape, frontal shield present, frontal line present, suprantennal line straight, eyes composed of 18 ommatidia. Antennule (Figure F) with proximal and distal articles subequal, medial shortest, third article with five pairs of aesthetascs arranged in five rows; antennae (Figure 27G) when extended back, reach posterior margin of pereonite 2, flagellum (Figure 27H) shorter than fifth article of peduncle, proximal and medial articles subequal in length, distal article the longest; medial article bearing one aesthetasc inserted distally, distal article with two aesthetascs inserted medially; mandibles (Figures 27I–J) with molar penicil consisting of eleven to fifteen branches, hairy lobes densely covered by minute setae, left mandible with a tuft of long setae, maxillule (Figure 27K) outer branch with 4 + 5 simple teeth, distal margin rectangular and with lateral tip; maxilla (Figure 27L) outer lobe about two times wider than inner lobe; maxilliped (Figure 27M) basal article with outer seta shortest. Pereopods (Figures 28B–D) inner claw shorter than outer claw, dactylar seta and ungual seta of simple apex not reaching the tip of outer claw. Uropod (Figure 28A) exopod twice longer than endopod.

*Male:* Pereopod 1 (Figure 28B) sternal margin of ischium and propodus and on sternal and tergal margins of merus and carpus with setae of trifid apex. Pereopod 7 (Figure 28D), sternal margin of merus, carpus and propodus with setae of trifid apex. Genital papilla as in Figure 28E. Pleopod 1 exopod (Figure 28F) triangular, outer margin concave; endopod (Figure 28G) apically bent outwards and with a longitudinal row of setae inserted subapically. Pleopod 2 exopod (Figure 28H) triangular, outer margin slightly concave, bearing setae, endopod (Figure 28I) reaching the anterior margin of pleopod 3. Pleopod 3 (Figure 28K) triangular, bearing setae. Pleopod 4 (Figure 28L) triangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 28M) triangular, with setae inserted as seen on pleopods 3 and 4.

*Remarks: Phalloniscus punctatus w*as described by Thompson (1879), as a member of the genus *Oniscus*. The original description was poorly detailed, focusing mainly on characters visible in dorsal view, neglecting the appendages, except for the second antenna and uropods. He also reported the color as light brown with darker spots. A more complete description of was given by Chilton (1901). However, the author analyzed specimens collected throughout New Zealand and observed variations in color and general body shape among the individuals of different localities. The author also reported that, although the species diverges from the diagnosis of the genus in many characters, he preferred to maintain this species in *Oniscus* Posteriorly, Budde-Lund (1908) erected the genus *Phalloniscus* to allocate *O. punctatus* and *O. kenepurensis* (Chilton, 1901). Bowley (1935) analyzed specimens collected in Australia and New Zealand, deposited in museums of the

supracited countries and in the Hamburg Museum, identified as *P. punctatus*, which, in fact, corresponds to distinct new species of *Phalloniscus* (New Zealand) and *Hanoniscus* (Australia) (Green et al. 2002).

*P. punctatus* resembles others members of *Phalloniscus* from New Zealand by the shape of *habitus*, oblong and somewhat convex, pleotelson of round apex and almost as large as the pereon, supra-antennal line present, cephalothorax with frontal lobe and lateral lobes present, frontal line present, supra-antennal line present, eyes composed of numerous ommatidia, antenna flagellum with third article longest, mandibles with hairy lobes covered by setae, maxilliped endite distal article with setae inserted as a tuft, pleopods exopods without respiratory areas, male pleopod 1 endopod distally bent outwards. *Phalloniscus punctatus* differs from the type-species of *Oniscus, O. asellus*, Linnaeus, 1758, by the general body shape in dorsal view, more flattened and with pereon much wider than pleotelson in *Oniscus*, uropod protopodite almost as long as wide in *P. punctatus* (much longer in *O. asellus*) and by the absense of respiratory fields. *Phalloniscus punctatus* can be readly distinguished from *P. kenepurensis* by the number of ommatidia (15 in *P. kenepurensis*) and maxilla 1 outer lobe with 4+5 (vs. 4+6 teeth and two setae in *P. kenepurensis*); from *P. chiltoni* Bowley, 1935 by the supra-antennal line, slightly sinuous in *P. chiltoni* and maxilla outer lobe, (vs. 4+6 teeth in the *P. Chiltoni*), from *P. armatus* by the shape of lateral lobes, more well developed in *P. armatus* and number of ommatidia (vs. 17 in *P. armatus*.

Although no type material was analyzed, the individuals studied herein correspond to individuals collected in the same locality of the specimen described by Thompson (Dunedin, New Zealand).The type species of *P. punctatus* has never been encountered (Taiti & Ferrara 1996). Vandel (1977) proposed the suppression of *P. punctatus* and this name is listed by Schmalfuss (2003) as *nomen dubium* and a synonym of *Hanoniscus tuberculatus*. But, we suggest that it must be considered a valid name, once it does not correspond to *H. tuberculatus*, as observed by Green (2002).

*Ecology and geographical distribution:* The region of Otago, South Island, New Zealand, is notable for the range and diversity of its landscapes (Galbraith & Burns 2007), marked by a cool temperate climate, with rainfall ranges from about 1000 to 2500 mm per annum, waterlogged soil and native forests domains the landscape at lower altitudes and native shrubland and tussock grassland at higher altitudes (Hall et al. 2001; Evans et al. 2012).

***Phalloniscus barbouri* (Van Name, 1926)**

Diagnosis and description: See Van Name (1926).

*Remarks:* The only specimen known, that is also the holotype (AMNH 5338) could not be analysed in detail. The specimen was very deteriorated and most appedices are laking (there are no antenna and only pieces of pereopods could be found).

***Phalloniscus baldonii* (Arcangeli, 1930)**

Diagnosis and description: See Arcangeli (1930).

*Remarks:* The type of *P. baldonii* could not be found and may be lost.

***Phalloniscus langi* Van Name, 1936**

(Figures 29, 30, 40B, 56).

*Philoscia langi* Van Name, 1936: 165, fig. 84;

*Phalloniscus langi* (Van Name, 1936). Schmalfuss, 2003: 179.

*Type material examined:*

*Paratypes:* British Guiana: Kamakusa, 1 ♂, I/1923, leg. H. Lang (AMNH 6570).

*Description:* Length: 2.6 mm. Specimen depigmented due to long preservation in ethanol 70%. Body outline as in Figure 29A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1-3 with posterior corners rounded, pereonites 4–7 with posterior corners directed backwards (Figure 29A); dorsum covered with trichorn setae (Figures 29B and E), *noduli laterales* absent; gland pores not visible. Pleonites epimera 3–5 (Figure 29A), directed backwards. Pleotelson (Figure 29A) triangular with slightly concave margins and acute apex. Cephalothorax (Figures 29A, C and D) without frontal lobelateral lobes small and triangular-shape, frontal line absent and suprantennal sinuous; eyeless; antennule (Figure 29F) with three articles subequal in length, distal article with ten aesthetascs in tuft; antennae (Figure 29G) , when extended back, reach posterior margin of pereonite 2, flagellum shorter than fifth article of peduncle, proximal and medial articles subequal, distal article shortest, medial article bearing one aesthetasc, inserted distally, distal article with one pair of aesthetascs, inserted medially, apical organ and free sensilla long; mandibles (Figures 29H–I) with molar penicil consisting of one branch, hairy lobedensely covered by setae; maxillule (Figure 29J) outer branch with 4 + 4 simple teeth; inner branch distal margin round with

two setae; maxilla (Figure 29K) outer lobe about four times wider than inner lobe; maxilliped (Figure 29L) endite with one stout seta, frontal face of endite with minute setae; inner seta slightly longer, second article with one tuft of setae inserted medially and one tuft of setae inserted distally. Pereopods (Figures 30B, C and D) with inner claw shorter than outer claw, dactylar seta covered by pilouse setae reaching the tip of outer claw and ungual setae simple reaching the tip of outer claw. Uropod as in figure 30A. Pleopods (Figures 30F–L) without respiratory area.

*Male:* Pereopod 1 (Figure 30B) sternal margin of ischium, merus and carpus with setae of double-serrate apex, one. Pereopod 7 (Figure 30D), sternal margin of merus, carpus and propodus with long simple setae. Genital papilla as in Figure 30E. Pleopod 1 exopod (Figure 30E) triangular, outer margin bearing small setae, endopod (Figure 30F) apically bent outwards with two longitudinal rows of individual setae inserted subapically. Pleopod 2 exopod (Figure 30H) triangular, outer margin concave, endopod (Figure 30I) slightly surpassing the anterior margin of pleopod 5. Pleopod 3 (Figure 30I) subrectangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 30L) triangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 30M) triangular, setae as seen on pleopods 3 and 4.

*Remarks: Phalloniscus langi* resembles other species of the genus by the presence of trichorn setae on dorsal surface, distal article of maxilliped endite with tuft of setae, absence of *noduli laterales* and resembles *P. pearsei* by the presence of dactylar seta pilouse. This species is readly distinguishable from other species of *Phalloniscus* by the absence of eyes and differs from other *Phalloniscus* of the American continent by the presence of two rows of minute setae inserted apically on pleopod 1 endopod and mandibles with molar penicil consisting of a single penicil. *Phalloniscus langi* differs from *P. punctatus* by the absence of frontal lobe, lack of gland pores, shape of pleopod 1 endopod, number of stout setae on maxilliped palp and setae on pereopods.

*Ecology and geographical distribution: P. langi* was collected in the Amazon Rain forest of British Guiana.

***Phalloniscus pearsei* (Van Name, 1936)**

(Figures 31, 32, 40C, 57).

*Philoscia spinosa* Pearse, 1917: 7.

*Philloscia pearsei* Van Name, 1936: 166–167, Fig. 85.

*Phalloniscus pearsei* Schultz, 1995a: 407; Boyko, 1997: 25; Leistikow & Wagele 1999: 26. Schmalfuss, 2003: 179.

*Type material examined:*

*Paratypes:* British Guyana: Dunoon, 06° 25'S, 58° 18', 6 ♂; 3 ♀, leg. A. S. Pearse (NMNH 236473). 8 ♂; 11 ♀, same data (NMNH 236474).

*Redescription:* Maximum length: ♀, 1.6 mm; ♂, 1.0 mm. Specimens depigmented due to long preservation in ethanol 70%. Body outline as in Figure 31A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1-3 with posterior corners rounded and pereonites 5–7 directed backwards (Figure 31A); dorsum covered with trichorn setae (Figures 31B), *noduli laterales* absent; gland pores not visible. Pleonites epimera 3–5 (Figure 31A), slightly directed backwards. Pleotelson (Figure 31A) triangular with slightly concave margins and acute apex. Cephalothorax (Figures 31A, C–D) lateral lobes small and triangular-shape, frontal line present, suprantennal line slightly sinuous, eyes composed of 5 ommatidia; antennule (Figure 31F) with proximal article longest, medial and distal articles subequal in length, third article with 12 aesthetascs in tuft; antenna (Figure 31G), when extended back, reach posterior margin of pereonite 3,flagellum shorter than fifth article of peduncle, proximal and medial articles subequal in length, distal article shortest; medial article bearing two aesthetascs inserted distally, distal article with two aesthetascs inserted medially; mandibles (Figures 31I–J) with molar penicil consisting of nine to ten branches; maxillule (Figure 31K) outer branch with 4 + 5 simple teeth, distal margin straight; maxilla (Figure 31L) inner lobe wider than outer lobe; maxilliped (Figure 31M) endite with distal margin bearing denticles, two stout setae, frontal face of endite with minute setae and a tuft of small setae inserted proximally on inner margin, basal article with outer seta smaller; second article with one tuft of setae inserted medially and one tuft of setae inserted distally. Pereopods (Figures 32B–D) with inner claw vestigial, ungual seta with simple apex, not surpassing the outer claw, dactylar seta distally plumouse, not surpassing the outer claw. Uropod (Figure 32A) exopod about twice longer than endopod.

*Male:* Pereopod 1 (Figure 32B) sternal margins of merus and carpus with setae of and propodus ornamentory setae double-serrate with cleft apex. Pereopod 7 (Figure 32D) tergal margins of merus and carpus with tufts of setae. Genital papilla as in Figure 32E. Pleopod 1 exopod (Figure 32F) triangular, outer margin concave with a lobe bearing one stout seta; endopod (Figure 32G) with longitudinal row of individual setae inserted medially and two longitudinal rows of small setae inserted subapically. Pleopod 2 exopod (Figure 32H) triangular, bearing a row of small setae on inner margin, outer margin slightly concave, endopod (Figure 32I) surpassing the anterior margin of pleopod 3. Pleopod 3 (Figure 32J) triangular, outer margin slightly concave, inner and outer margins bearing setae. Pleopod 4 (Figure 32K) rectangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 32L) triangular, with setae inserted as seen on pleopods 3 and 4.

*Remarks: Phalloniscus pearsei* resembles other species of the genus by the presence of thrichorn setae and *P. langi* by the presence of of dactylar seta pilouse and *P. langi* and *P. avrilensis* by the pereopod inner claw.vestigial. This species differs from other American species of *Phalloniscus* by the peculiar shape of the trichorn setae, number of aesthetascs of antennule (12) and pleopod 1 exopod with a lobe bearing one seta. Differs from *P. avrilensis* by the pereopod dactylar seta (simple in *P. avrilensis*) and by the mandible molar penicil number of branches (single branch in *P. langi*).

*Ecology and geographical distribution: P. pearsei* was collected in British Guiana, in the Amazon Rain Forest, present the litter, clay and sandy soil.

***Phalloniscus avrilensis* (Van Name, 1940).**
(Figures 33, 34, 40D, 58).

*Philloscia avrilensis* Van Name, 1940: 114–115, figs. 5–6.
*Phalloniscus avrilensis* Vandel, 1952: 136; Lemos de Castro, 1958: 5, figs. 7–11, Schultz, 1995: 407; Schmalfuss, 2003: 178.

*Type material examined:*
*Holotype:* Haiti: Bois D'Avril, 6,000 feet high, 1 ♂, 7/III/1935, leg. Bird & Winkhans (AMNH 8101).

*Redescription:* Length: 2.6 mm. Specimen depigmented due to long preservation in ethanol 70%. Body outline as in Figure 33A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1-3 with posterior corners rounded, pereonites 4–7 with posterior corners directed backwards (Figure 33A); dorsum covered with trichorn setae (Figures 33B, E), *noduli laterales* absent; gland pores not visible..Pleonites epimera 3–5 (Figure 33A) directed backwards. Pleotelson (Figure A) triangular with slightly concave margins and round apex. Cephalothorax (Figures 33A, C–D) lateral lobes triangular-shape, frontal line present and suprantennal slightly sinuous, eyes composed of 26 ommatidia; antennule (Figure 33F) with proximal and distal articles subequal in length and medial article shortest, distal article with six aesthetascs, two subapical pairs and one apical pair; antenna (Figure 33G) when extended back, reach posterior margin of pereonite 3; flagellum shorter than fifth article of peduncle, proximal and medial articles subequal in length, distal article shortest; medial article bearing two aesthetascs inserted distally, distal article bearing two aesthetascs inserted medially, apical organ and free sensilla missing; mandibles (Figures 33H–I) with molar penicil consisting of five to six branches, hairy lobe densely covered by setae, maxillule (Figure 33J) outer branch with 4 + 5 simple teeth; inner branch distal margin rounded with two setae inserted subapically on outer margin; maxilla (Figure 33K) outer lobe about two times wider than inner lobe; maxilliped (Figure 33L) endite with distal margin covered by minute setae, one stout seta, frontal face bearing setae; basal article with two setae subequal in length; second article with setae inserted in tuft. Pereopods (Figures 2A–C) with inner claw shorter than outer claw, ungual and dactylar setae of simple apex not reaching the tip of outer claw. Uropod missing.

*Male:* Pereopod 1 (Figure 34A) sternal margin of ischium and merus, sternal and tergal margins of carpus with setae of double-serrate apex, tergal margins of merus, carpus and propodus with sinuous trifid setae , carpus ornamental sensory setae with double–serrate apex,. Pereopod 7 (Figure 34C), with setae inserted as seen on pereopod 1. Genital papilla as in Figure 34D. Pleopod 1 exopod (Figure 34E) triangular, outer margin bearing setae; endopod (Figure 34F) apically bent outwards with a longitudinal row of setae inserted medially and a longitudinal row setae inserted subapically. Pleopod 2 exopod (Figure 34G) triangular, outer margin concave, bearing setae, endopod (Figure 34H) slightly surpassing the anterior margin of pleopod 5. Pleopod 3 (Figure 34I) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 34J) triangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 34K) triangular, setae as seen on pleopods 3 and 4.

Remarks: *P. avrilensis* resembles other species of *Phalloniscus* by the presence of trichorn setae, absence of *noduli laterales* and maxilliped endite distal article with setae inserted in tuft. Differs from *P. langi* by the presence of eyes and mandible molar penicil with six branches (one branch in *P. langi*), from *P. langi*, *P. pearsei* and *P. punctatus* by the dactylar seta with simple apex.

*Ecology and geographical distribution*: *P. avrilensis* was collected in Bois D'Avril, Haiti, Central America, 6,000 feet high. No additional ecological information about this species or collecting site is available.

***Phalloniscus loyolai* Zardo, 1989.**

(Figures 35, 36, 57).

*Phalloniscus loyolai* Zardo, 1989: 611–615, Figs. 1–7; Souza-Kury, 1998: 4; Schmalfuss, 2003: 179.

*Type material examined:*

*Paratypes:* Brazil, State of Paraná: Parque Barigui, Curitiba, in litter, 1 ♂, 29/X/1982, leg. C. M. L. Zardo (MZUSP 9704). 6 ♀, same data as male paratype (MZUSP 9705).

*Redescription:* Maximum length: ♀, 3.2 mm; ♂, 2.6 mm. Specimens depigmented due to long preservation in ethanol 70%. Color pattern as described by Zardo (1989). Body outline as in Figure 35A. Pereonite 1 with anterior corners slightly directed frontwards, pereonites 1–3 with posterior corners rounded, pereonites 4–7 with posterior corners slightly directed backwards (Figure 35A); dorsum covered with fan-shaped scale setae (Figures 35B, G); *noduli laterales* b/c and d/c coordinates as in figures 1C and D; gland pores not visible. Pleonites epimera 3–5 (Figure 35A), directed backwards. Pleotelson (Figure 35A) triangular with slightly concave margins and round apex. Cephalothorax (Figures 35A, E–F) lateral lobes small and triangular-shape, frontal line present, suprantennal line slighltly sinuous, eyes composed of 5 ommatidia; antennule (Figure 35H) with proximal article longest, medial and distal articles subequal in length, distal article with six aesthetascs, two subapical pairs and one apical pair; antenna (Figure 1I) when extended back, reach posterior margin of pereonite 2; flagellum shorter than fifth article of peduncle, proximal and medial article subequal in length, distal article longest; medial article bearing one aesthetasc inserted distally, distal article with two aesthetascs inserted medially; mandibles (Figures 35J–K)

with molar penicil consisting of five to six branches; maxillule (Figure 35L) outer branch with 4 + 4 simple teeth; inner branch distal margin triangular; maxilla (Figure 35M) outer lobe about two times wider than inner lobe; maxilliped (Figure 35N) endite distal margin with some denticles, one stout seta, frontal face of endite with setae; basal article outer seta smallest, second article with setae not inserted in tuft. Pleonites epimera 3–5 (Figure 35A) directed backwards. Pleotelson (Figure 35A) triangular with slightly concave margins and round apex. Pereopods (Figures 36B–D) with inner claw shorter than outer claw, ungual and dactylar setae of simple apex not surpassing outer claw. Uropod (Figure 36A) exopod twice longer than endopod. Pleopods exopods 1 and 2 (Figures 36F–H) with respiratory areas.

*Male:* Pereopod 1 (Figure 36B) sternal margin of carpus densely covered by setae with cleft apex, sternal and tergal margins of carpus and sternal margin of propodus with setae of double–serrate apex. Pereopod 7 (Figure 36D), sternal and tergal margins of ischium and merus and sternal margin of propodus with setae of double–serrate apex. Genital papilla as in Figure 36E. Pleopod 1 exopod (Figure 36F) ovoid, outer margin bearing small setae; endopod (Figure 36G) with a longitudinal row of setae inserted medially and a longitudinal row of setae inserted subapically. Pleopod 2 exopod (Figure 36H) triangular, outer margin concave, bearing setae; endopod (Figure 2I) slightly surpassing the anterior margin of pleopod 5. Pleopod 3 (Figure 36K) triangular, outer margin slightly concave, bearing setae. Pleopod 4 (Figure 36L) rectangular with setae inserted as seen on pleopod 3. Pleopod 5 (Figure 36M) triangular, setae as seen on pleopods 3 and 4.

*Remarks: Phalloniscus loyolai* resembles *P. pearsei* by the number of ommatidia and number of aesthetascs of antennule. This species resembles different genera of Dubioniscidae: outer endite of maxillule teeth number and shape (4+4, inner set simple in *Dubioniscus*), maxilliped endite distal article with setae inserted individually (vs. in tuft in *Phalloniscus*), dorsal surface covered by fan-shaped scale setae (vs. trichorns in *Phalloniscus*) and pleopods with respiratory areas, present in *Dubioniscus* (vs. absent in *Phalloniscus*). *This species* is also distinguishable from *P. avrilensis, P. langi, P. pearsei* and, *P. punctatus* by the presence of *noduli laterales*.

*Ecology and geographical distribution: P. loyolai* was recorded in the Parque Barigui, Curitiba, state of Paraná, inhabiting the litter of native vegetation, near tree trunks.

**Cladistics**

A single final cladogram with 23 clades, using implied weightening and K = 3 was recovered (figure 60). The results obtained is discussed as follow.

**Discussion of the characters and relations among the taxa**

Character 1: Ecological category: (0) runner, (1) roller, (2) creeper, (3) clinger.
Adapted from Schmidt (2002), based on Schmalfuss (1984).
(Figure 61)
L = 5; CI = 60; RI = 33

The taxa analysed in the present study were divided into four ecological categories (Schmalfuss 1984). Creepers are, in general, adapted to an endogean life, they are minute (5mm or less), short legs, longitudinal ribs and cylindrical cross-section (Schmalfuss 1984, Souza et al 2011). Runners have long legs, smooth tergites and can run fast (Schmalfuss 1984) and it is the most basal morphology among terrestrial isopods (Schmidt 2002). Rollers have the conglobation ability, rolling into a ball (Schmalfuss 1984). They are present in several different taxa and this character evolved independently many times in Isopoda (Schmidt 2002, 2003, Campos-Filho and Araujo 2011, Campos-Filho et al. 2017). Clingers have broad tergites and the epimere of the first pereonite concave and can cling tightly to the substrate or display the *tanatosis* behavior as defense strategies. Clingers are common among Oniscideans of the Squamiferae clade (Schmidt 2002, 2003, Cardoso et al. 2016). The state of character 3 (clinger) is a synapomorphy of the clade 2, with a reversal to the state 0 (runner) occurred for *P. pearsei and* an ambiguity was revealed in the clade *T. tomentosa* (creeper, state 2) + *P. birabeni* (roller, state 1).

Character 2: Scale-setae on dorsal cuticular surface: (0) fan-shaped scale setae; (1) trichorn scale setae.
Adapted from Leistikow (2001) and Schmidt (2002).
(Figure 62)
L = 2; CI = 50; RI = 80

Some ornamentations, such as the trichorns and scale-setae are present on the cuticular surface of the terrestrial isopods (Holdich and lincoln 1974) and they sensorial structures (Jans and

Ross 1963). The trichorn-setae is composed by an axis that arises from a concavity on the surface of the cuticle. (Sutton 1972, Holdich and Lincoln 1974). This kind of setae was present on the type-species of *Phalloniscus* (*P. punctatus*), *I. variegata, P. avrilensis, P. langi and N. singularis*. Scale-setae are shell shaped and the sheath is distally enlarged; the border may be serrate (Vandel 1960). That kind of sensorial setae is a synapomorphy of the clade 5, with a reversal in *N. nanus*.

Character 3: Pereonites, *noduli laterales*: (0) present; (1) absent.
Adapted from Schmidt (2007).
(Figure 63)
L = 1; CI = 100; RI = 100

Noduli laterales differs from the trichorn setae by the free portion, that outreaches the sheath (Schmidt 2002) and its relative position were defined by Vandel (1960). This structure and its position may be a diagnostic character for some taxa. They were always discernible in the same taxa that presented scale-setae, as well as, in the species with trichorn-setae, the *noduli laterales*, if present, were not discernible. The presence of *noduli laterales* (state 0) is a synapomorphy of the clade 5, with a reversal in *N. nanus*.

Character 4: Dorsum, dorsal surface: (0) smooth; (1) tuberculate.
Adapted from Leistikow & Schmidt (2002) and Schmidt (2002).
(Figure 64)
L = 4; CI = 25; RI = 25

Most Oniscidea have smooth dorsal surface (Schmidt 2002, 2003). Tubercles evolved several times independently (Schmalfuss 1977, Holdich 1984). Most species of terrestrial isopods have smooth dorsal surface (Schmidt 2002). In the results presented herein, tubercles evolved independently on *P. avrilensis, P. punctatus, N. carolii* and on clade 8.

Character 5: Dorsum, gland pores: (0) discernible; (1) not discernible.
Adapted from Schmidt (2002).
(Figure 65)
L = 3; CI = 60; RI = 33

The cuticular surface of isopods may have glandular pores (Gorvett 1956, Holdich and Lincoln 1974), although, sometimes, they are not visible (Schmidt 2002). Conspicuous gland pores were found only on *P. punctatus and* on clade 12.

Character 6: Pereonites, epimeron development of posterior corners: (0) pereonite 7 directed backwards; (1) pereonites 6 and 7 directed backwards; (2) pereonites 5 to 7 directed backwards.
New character proposal.
(Figure 66)
L = 8; CI = 25; RI = 14

This is a new character proposal. The direction of such borders, directed backwards, were analysed from pereonites 5 to 7 and they varied many times among the species analised. The state 0 of the character also evolved independently on *P. birabeni* and on clade 18, with two reversals to state 1 and two reversals to state 2. The state 1 also evolved on clade 13, with a reversal in *N. altamiraensis* to state 2.

Character 7: Pleonite 5, epimera length relative to pleotelson distal margin: (0) shorter than distal margin of pleotelson; (1) reaching or surpassing distal margin of pleotelson.
Adapted from Leistikow & Schmidt (2002).
(Figure 67)
L = 8; CI = 25; RI = 14

In some cases, the pleonite 5 may surpass the distal margin of pleotelson (Schmidt 2002). Among the species here analysed, only *P. avrilensis*, *P. pearsei and N. altamiraensis* presented this state of character (1), which evolved independently.

Character 8: Pleotelson, lateral margins, shape: (0) concave; (1) straight to slightly convex.
Adapted from Leistikow (2001) and Schmidt (2002).
(Figure 68)
L = 5; CI = 20; RI = 33

Pleotelson in Isopoda is a fusion of the sixth pleonite with the pleotelson, named pleotelson (Roman and Dalens 1999). The shape of this struture was coded by Leistikow (2001) and, in the present work, two shapes of lateral margins were considered. Those with straight or slightly convex

were coded as the same character (state 1), due to the inconspicuous difference between both states. This state of character is present in clade 1, with a reversal in state 3, appearing again, on clades 15 and 23 and again in *Novamundoniscus* sp. 3, revealing that this character evolved independently sometimes, corroborating the idea that this occurred several times in the natural history of the Oniscidea (Schmidt 2002).

Character 9: Pleotelson, distal margin, shape: (0) acute; (1) round.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 69)

L = 3; CI = 33; RI = 33

Pleotelson of terrestrial isopods are usually triangular, but may vary in shape, as the rectangular shape of Tylidae and the hourglass shape of the Armadiliidae (Schmidt 2002). Despite the general shape of pleotelson, in the present study, the tip of the structure was considered and two states of this character were coded. Acute apex is a more basal form, found in many families of Oniscidea (Araujo and Leistikow 2001, Campos-Filho et al. 2013, Campos-Filho et al. 2015). The state 1 is present in clade 6, with a reversal to state 0 in *N.* nanus and appears again in *C. goeldii*.

Character 10: Cephalothorax, dorsal view, with V-shaped depression on anterior margin: (0) absent; (1) present.

New character proposal.

(Figure 70)

L = 1

This is an automoporphy of *D. delamarei* in the results obtained herein. The real state of the character could not be confirmed for *Novamundoniscus sp.* 4, resulting in an ambiguity of this character for such taxon.

Character 11: Cephalothorax, dorsal view, frontal lobe: (0) absent; (1) present.

Adapted from Schmidt (2002).

(Figure 71)

L = 2; CI = 50; RI = 50

The frontal lobe is present in *P. punctatus* and in the clade 9. This may have evolved in different times inside Crinocheta (Schmidt 2002), but its absence is shared by most taxa in the cladogram.

Character 12: Cephalothorax, dorsal view (species without frontal lobe), anterior margin: (0) round; (1) triangular.

Adapted from Schmidt (2002).

(Figure 72)

L = 3; CI = 33; RI = 0

Taxa with frontal lobe were not coded, generalting two ambiguities in *P punctatus* and in clade 9. Round anterior margin appeared two times, in *P. avrilensis and* in *C. goeldii*.

Character 13: Cephalothorax, dorsal view, lateral lobes: (0) absent; (1) present.

Adapted from Schmidt (2002).

(Figure 73)

L = 1

Many taxa in Oniscidea present lateral lobes (Schmidt, Cardoso et al. 2016). This is a synapomorphy of *Novamundoniscus*, according to Schultz (1995). However, most taxa in the cladogram presented lateral lobes, except for the most basal species, *I. variegata*.

Character 14: Cephalothorax, dorsal view, species with lateral lobes, shape: (0) triangular; (1) round; (2) quadrangular.

Adapted from Schmidt (2002).

(Figure 74)

L = 8; CI = 25; RI = 40

The three states of character coded herein are well spread in Crinocheta, even among species of the same genus (Schmidt 2002; 2003). In clade 1, the state 0 is present in *N. singularis* and the changing to the state 1 in clade 3. Inside this clade, two independent reversals to state 2 (*P. birabeni and N. carolii*) *and* four reversals to state 0 in *Novamundoniscus* sp. 4 and clades 14 and 18, with another reversal to the round condition (state 1) in *Novamundoniscus* sp.1.

Character 15: Cephalothorax, frontal view, frontal line: (0) absent; (1) present.

Adapted from Leistikow (2001) & Schmidt 2002.

(Figure 75)

L = 5; CI = 20; RI = 33

Some Oniscidea have a frontal line (Leistikow 2001e), located between the anterior margin of eyes (Jackson 1928). This character may be used in the identification of some genera (Schmidt 2002). The absence of the frontal line (state 0) appears in clade 4, with two reversals in clade 7 and *P. loyolai*. Inside clade 7, there is another reversal to state 0 in *T. tomentosa.*

Character 16: Cephalothorax, frontal view, supraantennal line: (0) present; (1) absent.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 76)

L = 4; CI = 25; RI = 40

This line is located between the insertions of the antenna and divides the cephalotorax in frontal view in *frons* (below the line) and *profrons* (above the line) (Jackson 1928). Its presence and shape is also important for the identification of some species and genera (Schmidt 2002). The state 0 is the primitive state of character, with three reversals in clades 9 and 15 and in *D. delamarei and N. vandeli*.

Character 17: Cephalothorax, frontal view, supraantennal line shape (species with supraantennal line well defined): (0) sinuous; (1) straight.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 77)

L = 4; CI = 25; RI = 0

This line can be straight or sinuous (Leistikow, 2001e, Schmidt 2002). The state of character 0 is more primitive, changing to the straight condition four times, independently, in the inside the cladeogram, with four reversals in *P. punctatus*, *P. birabeni*, *C. goeldii and N. macrophthalmus.* The absence of supraantennal line in six taxa generated four ambiguities in clades 9 and 15 and on *D. delamarei* and *N. vandeli*.

Character 18: Cephalothorax, frontal view, eyes disposition: (0) not protruding eyes; (1) protruding eyes.
Adapted from Leistikow & Schmidt (2002).
(Figure 78)
L = 1; CI = 100; RI = 100

Protruding eyes is a synapomorphy of the sister group *Tropiscia+Ischioscia* (Leistikow and Schmidt 2002) and only three species herein discussed presented such characteristic eyes disposition: *I. variegata* (basal taxon), *P. punctatus* (type-species of *Phalloniscus*) and, *N. singularis* (that shows affinities with *Ischioscia*). This character changes to the state 1 as a synapomorphy of clade 3.

Character 19: Antennula, presence of simple setae on medial article: (0) with no setae; (1) bearing setae.
Adapted from Schmidt (2002).
(Figure 79)
L = 1; CI = 100; RI = 100

Most species of Crinocheta more derivated have only aesthetascs on first antenna, but some still present setae (Schmidt 2002). Those structures could be found in only three species, *I. variegata*, *P. punctatus* and *N. singularis*. This character changes to the state 0 only once (synapomorphy), in clade 3.

Character 20: Antennula, number of aesthetascs: (0) 4; (1) 5; (2) 6; (3) 7; (4) 8; (5) 10; (6) 12.
New character proposal.
(Figure 80)
L = 14; CI = 42; RI = 11

Three-articulate first antennae with aesthetascs on distal article is an autapomorphy of the Oniscidea still present in the majority of Crinocheta and number of aesthetascs on antennule varies from a few to many (Schmidt 2002, 2003). In the present work, this multistate character varied from 4 up to 12. The clade 1 presents the state 3 and a changing to the state 5. The clade 3 presents a reversal from state 5 to state 2 and the clade 4 presents a changing to the state 6 and, this state suffers three reversals, one to state 4 (*P. birabeni*), one to state 0 (*N. carolii*) and one to the state 2

in clade 10. Beyond the clade 10, more reversals can be found. In clade 11, there is a reversal to the state 3 in *P. setosus and N. altamiraensis*. However, inside clade 11 more reversals can be observed. One to the state 4 in *Novamundoniscus* sp. 4, one to state 0 in *D. delamarei* and one to the state 2 in clade 15. Three reversals are present beyond clade 17. Two to state 0 in *C. goeldii* and *N. macrophthalmus* and one to state 1 in *Novamundoniscus* sp. 3.

Character 21: Antennula, distal article, lateral tip: (0) absent; (1) present.
Adapted from Leistikow (2001) and Schmidt 2007.
(Figure 81)
L = 1; CI = 100; RI = 100

In some species, the first antenna may have an lateral tip (Leistikow & Schmidt 2002, Schmidt 2002). This character is also present in some *Dubioniscus* (Cardoso et al. 2016) and, in herein, it is a synapomorphy of the clade 15 (state 1).

Character 22: Antenna, range related to pereonites in dorsal view: (0) pereonite 1; (1) pereonite 2; (2) pereonite 3 and beyond.
New character proposal.
(Figure 82)
L = 5; CI = 40; RI = 72

The range of the antenna related to pereonites in dorsal view varies among Oniscidea. Ligiidae usually have very long antenna, sometimes, as long as the pereon (Jackson 1922). Some others, like Bathytropidae, Platyarthrydae and Trachelipodidae, have short antenna, rarely surpassing the anterior margin of pereonite 2 (Vandel 1952, Souza et al. 2011, Cardoso et al. 2016). Most Dubioniscidae also have short second antenna (Schultz 1995, Cardoso et al. 2016. In the present work, the most primitive state of character was the surpassing of pereonite 3 (state 2), with four reversals, three to state 1 (*P. langi*, *N. altamiraensis* and clade 16) and a reversal to state 0 in clade 8. In clade 17, the state of character changes from 2 to 0 in *Novamundoniscus* sp. 3.

Character 23: Antenna, fifth peduncle article related to flagellum: (0) subequal; (1) longer (2) much longer (about twice longer than flagellum).
Adapted from Leistikow (2001) and Schmidt (2002).
(Figure 83)

L = 5; CI = 40; RI = 0

The peduncle may be as long as the flagellum or shorter among Oniscideans (Schmidt 2002, 2003, Cardoso 2017). In the present work, this character was coded as three states: shorter, subequal or longer. In clade 1, the fifth article of peduncle is longer than flagellum (state 1). Five reversals can be found beyond, four to the state 0 in *P. punctatus*, *T. tomentosa*, *C. goeldii* and *N. macrophthalmus* and one to state 2 (*N. carolii*).

Character 24: Antenna, flagellum, number of articles: (0) three; (1) three, medial and distal articles delimited by an immovable suture; (2) two.
Adapted from Leistikow (2001) and Schmidt (2002).
(Figure 84)
L = 5; CI = 50; RI = 50

The number of articles of the flagellum of the antenna may vary from to to more than twenty among terrestrial isopods (Sutton 1984, Schmidt 2008). Among Crinocheta, basal species have up to 18 articles, while the most derivated species have only two or three articles (Schmidt 2002). Dubioniscidae are considered to have three articles (Schultz 1995), sometimes showing a fusion between articles two and three (Lemos de Castro 1968). The most primitive state is the flagellum with three articles (state 0), with one reversal to state 2 (clade 7) and two to state 1 in *P. birabeni* and *C. goeldii*.

Character 25: Antenna, flagellum triarticulated, length of third article related to second: (0) third the longest; (1) second the longest; (2) subequal.
Adapted from Cardoso (2017).
(Figure 85)
L = 7; CI = 28; RI = 37

Most species of Dubioniscidae have a gradual alongation of the articles of the flagellum, from the most proximal to the most distal article (Lemos de Castro 1960, Schultz 1995, Schmalfuss 2003). In the cladogram presented herein, the state 0 is the most primitive, with five reversals to the state 2 in *P. avrilensis*, *P. birabeni*, *Novamundoniscus* sp. 2, *N. macrophthalmus* and in clade 21 and two reversals to state 1 in *D. delamarei and N. gracilis*. Due to presence of taxa with flagellum with two articles, 2 ambiguities can be found (*T. tomentosa* and clade 9).

Character 26: Antenna, flagellum triarticulated, length of third article related to first and second articles: (0) third article reduced, related to the other two; (1) third article is not the shortest.
Adapted from Cardoso (2017).
(Figure 86)
L = 5; CI = 20; RI = 0

The most primitive state of this character is the state 1. There is a reversal to the state 0 in clade 4, in *D. delamarei* and *N. gracilis*, totalizing three changes to this state of character. The state 1 appears again in clade 6 and two ambiguities of taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 27: Antenna, flagellum triarticulated, second article, number of asthetascs rows: (0) one; (1) two.
New character proposal.
(Figure 87)
L = 1

Only *P. punctatus* showed two rows of asthetascs on the second article (state 1). Two ambiguities can be found for taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 28: Antenna, flagellum triarticulated, second article, insertion of rows of asthetascs: (0) one medial row; (1) one distal row; (2) two rows.
New character proposal.
(Figure 88)
L = 3, CI = 66, RI = 50

The presence of a distal row (state 1) was the most primitive condition of the character, with three reversals, one to state 2 (*P. punctatus*) and two to state 0 (*N. gracilis and* clade 20). Two ambiguities can be found for taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 29: Antenna, flagellum triarticulated, number of asthetascs on second article: (0) 1; (1) 2; (3) a row with a pair plus a single aesthetasc
New character proposal.
(Figure 89)

L = 3, CI = 66, RI = 50

The primitive condition of this character is the state 1, with four reversals, one to state 3 (*P. punctatus*, one to state 2 in *P.* birabeni and two to state 0, in *P. langi* and clade 16. Two ambiguities can be found for taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 30: Antenna, flagellum triarticulated, third article, insertion position of asthetascs: (0) medial portion; (1) distal portion; (2) two rows; (3) absent.
New character proposal.
(Figure 90)
L = 5, CI = 60, RI = 0

In oniscideans whose flagellum consists of only 2 or 3 articles, the distal article can have 2-4 rows of aesthetascs, which probably evolved from the fusion of several articles (Schmidt 2002). Herein, the primitive state is 0 (clade 1), with four reversals, two to state 1 (*P. avrilensis* and *N. dissimilis*), one to state 2 in *N. altamiraensis* and one to state 3 to *D. delamarei.* Two ambiguities can be found for taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 31: Antenna, flagellum triarticulated, number of asthetascs on third article: (0) 1; (1) 2; (2) 3; (4) absent.
Adapted from Schmidt (2002).
(Figure 91)
L = 6, CI = 66, RI = 0

The primitive state of the character (state 1) is widespread among taxa of the cladogram. Five reversals can be found, one to state 0 in *N. gracilis*, one to state 3 (*N. altamiraensis*), one to state 4 (*D.* delamarei), two to state 2 (*N. singularis* and *P. birabeni*). Two ambiguities can be found for taxa with flagellum with two articles (*T. tomentosa* and clade 9).

Character 32: Mandibles, lacinia mobilis basally covered with spines (hairy lobe): (0) not hairy; (1) hairy.
Adapted from Schmidt (2002).
(Figure 92)
L = 6, CI = 66, RI = 0

Adjacent to the lacinia mobilis there is a lobe, usually is covered by small scales, so called hairy lobe, occasionally be fused with the lacinia on the right mandible (Schmidt 2002). Usually the lobe is covered with spines and, sometimes, it is naked. In the cladogram presented herein, the presence of hairy lobe (state 1) is the most primitive, with three reversals to state 0 in *N. carolii*, *Novamundoniscus* sp. 5 and in clade 16.

Character 33: Maxillule, inner branch, lateral tip: (0) absent; (1) present.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 93)

L = 3, CI = 33, RI = 80

In Crinocheta, the inner branch of maxillule can bear an lateral tip on latero-distal corner (Leistikow & Schmidt 2002, Schmidt 2002). Some Dubioniscidae species also present this protusion (Cardoso et al. 2016). In the present work, the absence of lateral tip was the primitive condition, with five reversals in clade 9, *Novamundoniscus* sp. 4, *N. gracilis*, *N. vandeli* and *Novamundoniscus* sp. 6.

Character 34: Maxillule, inner endite, laterodistal corner shape: (0) triangular; (1) round; (2) rectangular.

Adapted from Schmidt (2002).

(Figure 94)

L = 7, CI = 28, RI = 58

The laterodistal corner of the inner endite is rounded in many Crinocheta (Schmidt 2002). Here, this character was coded in three states: round, triangular or rectangular. The state 1 is the most basal. Three reversals to state 0 occurred (*P. punctatus*, *T. tomentosa* and clade 17), three to state 2 (clade 5, *N. vandeli* and *P. loyolai*) and a reversal to the primitive state in clade 10.

Character 35: Maxillule, outer branch, set of teeth, composition: (0) 4+4; (1) 4+5; (2) 4+6.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 95)

L = 6, CI = 33, RI = 42

This character may show many different configurations among the Crinocheta (Leistikow & Schmidt 2002, Schmidt, 2002, 2003, 2008). Among the species analysed, three states were coded (4+4), (4+5), (4+6). The first one is considered a synapomorphy of Dubioniscidae (Schultz 1995), although it is also found in sister groups of this taxon (Lopes and Araujo 2003). In fact, most species considered Dubioniscidae prior this study have the 4+4 configuration. The character changes from the state 2 (primitive) in reversals to state 1 in clade 2 and *N. altamiraensis*. Three reversals to state 0 in *P. langi, P. birabeni* and clade 10 and another reversal from the state 1 to 2 in *N. carolii.*

Character 36: Maxillule, outer endite, outer margin, pilose setae disposition: (0) all over the margin, reaching outer tooth; (1) interrupted in the concavity; (2) not reaching the outer tooth.
Adapted from Campos-Filho (2014).
(Figure 96)
L = 7, CI = 28, RI = 50

This character presented a reversal from the state 0 (primitive) to the state 1 in clade 3 and clade 10 *and* to state 2 in *N. gracilis*, with five other reversals to the primitive condition in clade 5, clade 13, in *C. goeldii*, *N. macrophthalmus* and *Novamundoniscus* sp. 1.

Character 37: Maxillule, outer branch, inner set of teeth apex: (0) all simple; (1) all cleft; (2) both simple and cleft present.
Adapted from Leistikow (2001) and Cardoso 2017.
(Figure 97)
L = 8, CI = 25, RI = 33

Prior this work, this character was useful to diagnose the genera of Dubioniscidae, being the genus *Novamundoniscus* composed by species with the inner set with all teeth cleft (Schultz 1995), although *N. gracilis* have this set simple (Lopes and Araujo 2003). In the present study, three states if this character were coded: all simple, all cleft or both simple and cleft present. The primitive state in the cladogram is the state 2, changing to the state 0 in clade 2. Two reversals to the primitive state present (clade 7 and *N. altamiraensis*) and five to the state 1 (*P. birabeni*, *P. setosus*, *N. gracilis*, *N. dissimilis* and clade 20.

Character 38: Maxilla, shape: (0) distally round (1) distally truncate.

Adapted from Schmidt (2002).

(Figure 98)

L = 6, CI = 33, RI = 20

The maxilla can be distally round or distally truncate (Schmidt 2002). In the cladogram here presented, four reversals to the state 1 can be found in *P. avrilensis*, *C. goeldii*, *Novamundoniscus* sp. 1 and clade 13.

Character 39: Maxilla, relative width between outer lobe x medial lobe: (0) outer lobe about 3x wider (1) outer lobe about 2x wider; (2) subequal; (3) inner lobe wider than medial lobe.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 99)

L = 13, CI = 23, RI = 9

Outer lobe can be as wide as the medial lobe or even three or more times wider (Leistikow 2001, Schmidt 2002). The clade 1 presents the state 2, with reversals to the state 3 in *N. singularis*, *P. pearsei and T. tomentosa* (three reversals), five to the state 1 in *P. avrilensis*, *N. carolii*, *Novamundoniscus* sp. 4, clades 14 and 19 and, back to state 2 in *Novamundoniscus* sp. 3 and *N. macrophthalmus*.

Character 40: Maxilliped, distal article, set of setae: (0) individual setae; (1) as a tuft.

Adapted from Leistikow (2001) and Schmidt (2002).

(Figure 100)

L = 1, CI = 100, RI = 100

One of the most useful characters for the diagnosis of Dubioniscidae is the set of individual setae on distal article of maxilliped (Schultz 1995, Cardoso et al. 2016), which also evoluted several times in Crinocheta (Schmidt 2002). The state 0 is a synapomorphy of clade 10.

Character 41: Maxilliped, basal article, outer distal margin, fringe of setae: (0) absent; (1) present.

Adapted from Campos-Filho (2014).

(Figure 101)

L = 4, CI = 25, RI = 62

Some Crinocheta shows the presence of fringe of setae on outer distal margin of basal article of maxilliped (Campos-Filho2014). The cladogram shows a reversal to the state 1 (absent) in *P. punctatus, N. carolii and* clade 10 and, back to the state 0 in *Novamundoniscus* sp. 3.

Shape of distal margin of maxilliped palp

Character 42: Maxilliped, palp, distal margin shape: (0) rectangular; (1) round.
Adapted from Campos-Filho (2014).
(Figure 102)
L = 2, CI = 50, RI = 75

This structure can be rectangular or round (Schmidt 2002). Two reversals from the state 1 to the state 0 appeared in *P. punctatus and* clade 6.

Character 43: Maxilliped, palp, distal margin: (0) without denticle-like lobes; (1) with denticle-like lobes.
Adapted from Schmidt (2002).
(Figure 103)
L = 7, CI = 14, RI = 45

Denticles on maxilliped palp are found in different families of Crinocheta (Schmidt 2002, 2003). Two reversals to the state 0 (clades 13 and 18).

Character 44: Maxilliped, palp, frontal face: (0) naked; (1) hairy.
Adapted from Schmidt (2002).
(Figure 104)
L = 8, CI = 12, RI = 30

Tufts of setae can be found on maxilliped palp frontal face throughout Crinocheta (Schmidt 2002, 2003). In this study two reversals appeared to the state hairy (1) in clade 14 and in *P. loyolai*.

Character 45: Pereopods 1-7, dactylus, inner claw length related to outer claw: (0) Inner claw vestigial; (1) inner claw shorter than outer claw (2) inner claw subqual or as long as outer claw, more than 75% the length of outer claw.
Adapted from Schmidt (2002).

(Figure 105)
L = 10, CI = 20, RI = 0

The inner claw can of similar length or even vestigial in Isopoda (Schmidt 2002, 2003, 2008). A reversal to the state 1 appears in clade 19, four to the state 0 (*P. punctatus, P. pearsei, Novamundoniscus* sp. 3 and *N. dissimilis*) and five to the state 2 (*T. tomentosa, N. nanus, N. altamiraensis, N. vandeli and* clade 16.

Character 46: Pereopods 1-7, dactylus, dactylar seta length related to outer claw: (0) dactylar seta shorter than outer claw; (1) dactylar seta as long as or longer than outer claw.
Adapted from Schmidt (2002).
(Figure 106)
L = 7, CI = 14, RI = 40

This structure can be shorter than outer claw or even longer than the last one (Araujo and Leistikow 1999, Leistikow & Schmidt 2002, Schmidt 2002). The cladogram reveals three reversals to the state 0 in clade 11, *N. vandeli and N. loyolai.*

Character 47: Pereopods 1-7, dactylus, ungual seta length related to outer claw: (0) ungual seta shorter than outer claw; (1) ungual seta as long as or longer than outer claw.
Adapted from Schmidt (2002).
(Figure 107)
L = 7, CI = 14, RI = 45

As the anterior charater listed herein, the ungual seta can be shorter as long as, or longer than outer claw of pereopod (Leistikow & Schmidt 2002, Schmidt 2002, Campos-Filho 2014). The state of character 1 is a synapomorphy of clade 5. Six reversals appeared in *T. tomentosa, Novamundoniscus* n. sp. 4, *D. delamarei, N. gracilis*, *Novamundoniscus* sp. 2 and clade 23.

Character 48: Pereopods 1-7, dactylus, dactylar seta, shape of tip: (0) simple; (1) enlarged on tip; (2) apically fringed with setules.
Adapted from Campos-Filho (2014) and Schmidt (2002).
(Figure 108)
L = 5, CI = 40, RI = 25

This structure can have many different states inside Oniscidea (Leistikow and Schmidt (2002, Schmidt, 2002, 2003), but three states in the present study: simple, enlarged on tip or apically fringed with setules (as seen in Leistikow, 2001). One reversal to the state 2 appears in clade 4. The state 1 is an autapomorphy of *P. birabeni.*

Character 49: Pereopod 1, Carpus, antennal brush, proportion in length related to carpus length: (0) extremely reduced (less than 20%); (1) about 1/3; (2) about half the length; (3) about ¾ or more.
Adapted from Leistikow & Schmidt (2002) and Schmidt (2002).
(Figure 109)
L = 8, CI = 37, RI = 28

This character appeared as a single reversal to the state 3 in *P. langi*. The state 1 appears in clade 3 and, again (three reversals) in *N. carolii, N. gracilis and Novmundoniscus* sp. 1. The state 0 is an autapomorphy of *N. singularis.*

Character 50: Pereopod 1, carpus, width in relation to length (%): (0) up to 50%; (1) more than 50%.
Adapted from Leistikow (2001) and Cardoso (2017).
(Figure 110)
L = 6, CI = 16, RI = 44

In species with slender legs, such as Philosciidae and other runners, carpus is usually much longer than wide (Leistikow 2001, Schmidt, 2002), but clingers (like most Dubioniscidae) usually have stout legs, with carpus almost as long as wide (Schmidt 2003, Cardoso et al. 2017). This character appears in state 0 in clade 1, with three reversals to state 1 in clades 7 and 17 and in *Novamundoniscus* sp. 5. Beyond clade 17 two reversals back to state 0 can also be found in clades 20 and 23.

Character 51: Pereopod 1, Carpus, sensorial seta apex shape: (0) double-fringe (2-1-2); (1) triple-fringe (3-1-3); (2) multiple-fringe; (3) with fringes and double apex; (4) with fringes and globose apex.
Adapted from Leistikow (2001) and Cardoso (2017).
(Figure 111)

L = 12, CI = 33, RI = 38

This multistate character varies among the Crinocheta (Leistikow 2001, Schmidt, 2002, 2003, Cardoso 2017) and it was coded in five different states herein. The primitive state of the character in the cladogram is 4, with a single reversal to state 0 in clade 2 as a synapomorphy of this clade, a reversal back to state 4 in *P. langi*, three reversals to state 1 in *N. carolii, N. gracilis and Novamundoniscus* sp. 2; five reversals to state 2 in clades 8, 14 and 23 and in *Novamundoniscus* sp. 3 and in *N. vandeli*. Two reversals to state four apeears in *P. pearsei* and in clade 12.

Character 52: Pereopod 7, ischium, fringe of long setae on dorsal margin: (0) absent; (1) present.
New character proposal.
(Figure 112)
L = 2, CI = 50, RI = 66

This structure present in only four species among all Isopoda of the present study, appearing in two reversals of the state 0 to the state 1 in clade 14 and in *Novamundoniscus* n. sp. 1.

Character 53: Genital papilla ventral shield, width x length relation: (0) about 3 times longer than larger; (1) about 2 times longer than larger.
New character proposal based on Schmidt (2002).
(Figure 113)
L = 4, CI = 25, RI = 50

The primitive state of this character is (0), is the most common state among taxa analysed herein, with four reversals to state 1 in *P. punctatus, N. gracilis, Novamundoniscus* sp. 3 *and* clade 21.

Character 54: Pleopod exopod, respiratory fields: (0) absent; (1) present.
Adapted from Leistikow & Schmidt (2002) and Schmidt (2002).
(Figure 114)
L = 4, CI = 25, RI = 0

The presence of respiratory fields evolved several times inside Crinocheta (Schmidt 2002), permitting for many species the colonization of the most different terrestrial habitats, even deserts

(Hoffman 1984, Linsenmair 1986, Kacem-Lachkar 2000). Four reversals to state 1 appeared in *P. birabeni, N. nanus, D. delamarei* and *P. loyolai.*

Character 55: Pleopod 1 exopod (males), shape: (0) round, elipzoidal or ovoid; (1) rectangular; (2) triangular.
Adapted from Leistikow & Schmidt (2002) and Schmidt (2002).
(Figure 115)
L = 11, CI = 18, RI = 35

This structure can be found in different shapes among Crinocheta, from round to rectangular or triangular forms, varying even among species of the same genus (Leistikow & Schmidt 2002, Schmidt 2002). The primitive state is 2, with a single reversal to the state 0 in clade 4, 6 reversals to the state 1 in the terminal taxa *N. singularis, P. langi, N. carolii, C. goeldii, N. vandeli* and in clade 11 and four back to state 2 in *P. birabeni, P. setosus, N. gracilis* and *Novamundoniscus* sp. 6.

Character 56: Pleopod 1 exopod (males), presence of lobe: (0) absent; (1) present.
Adapted from Leistikow & Schmidt (2002) and Cardoso 2017.
(Figure 116)
L = 4, CI = 25, RI = 0

The presence of a lobe on pleopod 1 exopod evolved several times among Crinocheta (Lemos de Castro 1960, Leistikow 2001e, Leistikow & Schmidt 2002, Schmidt 2002, 2003). The absence of this lobe (state 0) is the primitive state and three reversals to the state 1 appeared in *P. pearsei, N. dissimilis* and *Novamundoniscus* sp. 1.

Character 57: Pleopod 1 endopod (males), distal portion, presence of setae minute: (0) absent; (1) present.
Adapted from Leistikow & Schmidt (2002), Campos-Filho (2014).
(Figure 117)
L = 5, CI = 20, RI = 20

In general, Dubioniscidae have no setae on pleopod 1 exopod. (Schmidt, 2003, Cardoso et al. 2016). Lemos de Castro (1959) drawing suggests the presence of minute setae on pleopod 1 exopod of *N. vandeli*. However, in the present work, no such structures could be found on the types

of this species. The primitive state in the cladogram is the absence of such setae (0), with four reversals to the state 1 in *P. avrilensis, N. dissimilis, P. loyolai and* in clade 12.

Character 58: Pleopod 1 endopod (males), width x length relation: (0) about 2x longer than wide; (1) about 3 or more times longer than wide.
New character proposal.
(Figure 118)
L = 4, CI = 25, RI = 40

In the present work, it had been noticed that, sometimes, the endopod of pleopod 1 can be conspicuously enlarged in some species. The primitive state of the character in the cladogram was the state 1, with two reversals to the state 0 in *Novamundoniscus* sp. 4 and in clade 17 and a single reversal back to the state 1 in clade 23.

Character 59: Pleopod 1 endopod (males), proximal portion length related to pleopod total length (approx.): (0) 30%; (1) 35%; (2) 40%; (3) 45%; (4) 50%.
New character proposal.
(Figure 119)
L = 10, CI = 40, RI = 0

The relations between proximal and distal portions of pleopod 1 endopod has been neglected in phylogenetic analyses of Oniscidea taxa, although it proved to be a good character in the description of some species analysed herein. The primitive state is 0, with a single reversal to the the state 1 in clade 3, two reversals to state 2 in *D. delamarei* and *N. dissimilis*, a single reversal to the state 3 in *N. nanus*, a single reversal to the state 4 in *P. birabeni* and three reversals back to the state 0 in *Novamundoniscus* sp. 2, *Novamundoniscus* sp. 5 and *Novamundoniscus* sp. 6.

Character 60: Pleopod 1 endopod (males), distal portion, apex orientation (0) outwards; (1) downwards.
Adapted from Campos-Filho (2014).
(Figure 120)
L = 3, CI = 33, RI = 0

The primitive state of this character (0) can be easily found among Crinocheta (Schmidt 2002, 2003) and two reversals to the state 1 appeared in the cladogram in *Novamundoniscus* sp. 1 and *Novamundoniscus* sp. 4.

Character 61: Pleopod 2 exopod (males), width x length relation: (0) up to 50% longer than larger; (1) more than 50% longer than larger.
New character proposal.
(Figure 121)
L = 4, CI = 25, RI = 0

As observed for character 59, the width x length relations of pleopod 2 exopod has been neglected in phylogenetic analyses of Oniscidea. The primitive state is 0, with three reversals to the state 1 in *P. punctatus, Novamundoniscus* sp. 1 and *Novamundoniscus* sp. 4.

Character 62: Pleopod 2 exopod (males), extremity, shape: (0) lanceolate; (1) round.
Adapted from Schmidt (2002).
(Figure 122)
L = 8, CI = 12, RI = 30

The shape of the extremity of pleopod 2 exopod can vary in Crinocheta, from a more acute (lanceolate) shape to a round apex (Schmidt 2002). The round condition (state 1) is the primitive state, with five reversals to the state 0 in *P. langi*, *T. tomentosa, N. nanus* and in clades 11 and 19 and three reversals back to the state 1 in *N. vandeli, P. loyolai and* in clade 15.

Character 63: Pleopod 2 endopod (males), length relative to the exopod: (0) longer than exopod; (1) subequal.
Adapted from Schmidt (2002).
(Figure 123)
L = 6, CI = 16, RI = 37

Usually, the endopod of pleopod 2 is longer the exopod, reaching even the fifth pleopod exopod (Leistikow & Schmidt 2002; Schmidt 2002, 2003). In the present work, most species analysed corroborated this assumption, but, for some species, the endopod was subequal or even slightly shorter than exopod. In fact, this latter condition was the primitive state (1), with two

reversals to the state 0, in clades 3 and in *P. loyolai* and three reversals back to the state 1 in *N. nanus, Novamundoniscus* sp. 2 and in clade 21.

Character 64: Pleopod 3 exopod (male) shape: (0) triangular; (1) rectangular.
Adapted from Schmidt (2002).
(Figure 124)
L = 6, CI = 16, RI = 44

The exopod of pleopod 3 in Crinocheta can be triangular or rectangular (Leistikow & Schmidt 2002, Schmidt 2002, 2003). Both can be found among Dubioniscidae (Lemos de Castro 1959, Schultz 1995, Cardoso 2016). Triangular pleopod 3 (state 0) is the primitive state, with three reversals in *N. singularis, P. birabeni* and in clade 4. Three reversals back to the primitive state (0) appeared in *Novamundoniscus* sp. 4 and in clades 7 and 22.

Character 65: Pleopod 3 exopod (male), shape related to pleopods 2 and 4: (0) pleopod 3 like; (1) pleopod 4 like.
New character proposal.
(Figure 125)
L = 5, CI = 20, RI = 33

This new character proposal is based on the pleopods 2 and 4 shapes, coded as pleopod 3-like or pleopod 4-like. The primitive state of this character is the state 1, with four reversals to the state 0 in *P avrilensis, N. carolii and* in clades 13 and 22 and with a single reversal back to the state 1 in the clade 15.

Character 66: Pleopod 3 exopod (male), fringe of minute setae on distal portion: (0) absent; (1) present.
New character proposal.
(Figure 126)
L = 4, CI = 25, RI = 57

Minute scale setae can be found in different taxa among Crinocheta (Leistikow 2001e, Schmidt 2002, 2003, 2007). The primitive state in the cladogram is the state 0 and three reversals to

the state 1 appeared in *P. pearsei and* in the clades 12 and 19. A single reversal back to the state 0 appeared in *Novamundoniscus* sp. 1.

Character 67: Pleopod 4 exopod (male), shape: (0) triangular; (1) rectangular.
Adapted from Schmidt (2002).
(Figure 127)
L = 5, CI = 20, RI = 20

Both triangular or rectangular shape of pleopod 4 can be found among Oniscidea (Leistikow 2001e, Schmidt & Leistikow 2002, Schmidt 2002). The primitive state in the cladogram is the state 0, with two reversals to the state 1 in *N. singularis* and in the clade 4. Three reversals back to the state 0 appeared in *T. tomentosa, N. nanus and* in *Novamundoniscus* sp. 4.

Character 68: Pleopod 4 exopod (male), fringe of minute setae on distal portion: (0) absent; (1) present.
New character proposal.
(Figure 128)
L = 3, CI = 33, RI = 71

As the fringe of minute setae on pleopod 3 (character 66), this is a new character proposed herein. The primitive state of character is 0, with three reversals to the state 1 in *P. pearsei*, *Novamundoniscus* sp. 5 and in the clade 19.

Character 69: Pleopod 4 exopod (male), outer margin, shape: (0) concave; (1) straight.
Adapted from Schmidt (2002).
(Figure 129)
L = 9, CI = 11, RI = 0

For most species, the outer margin of pleopod 4 is concave, but straight margin of this pleopod is also found among Crinocheta (Schmidt 2002). In fact, among the Dubioniscidae analysed herein, most species have straight margin on pleopod 4 outer margin. The primitive state of this character is 1, with seven reversals to the state 0 in *P. avrilensis, P. birabeni, P. setosus, D. delamarei, N. gracilis, N. vandeli and* in clade 22. A single reversal backk to the state 1 appeared in *P. loyolai.*

Character 70: Pleopod 5 exopod (male), shape: (0) triangular; (1) subrectangular or trapezoidal.
Adapted from Schmidt (2002).
(Figure 130)
L = 8, CI = 18, RI = 22

The pleopod 5 in Crinocheta can be triangular or subrectangular / trapezoidal (Schmidt 2002). The state 0 is the primitive one, with four reversals to the state 0 in *Novamundoniscus* sp. 4, *N, gracilis, P. loyolai and* in clade 4. Two reversals back to the state 1 appeared in *N. carolii* and in the clade 10.

Character 71: Uropod, endopod length relative to exopod: (0) shorter; (1) subequal (2) longer.
Adapted from Cardoso (2017).
(Figure 131)
L = 4, CI = 50, RI = 0

For this character, almost all species analysed herein presented endopod shorter than exopod. This is the expected for the majority of Crinocheta (Leistikow & Schmidt 2002, Schmidt 2002, 2003, 2007). The shorter endopod (state 0) is the primitive state of this character. Two reversals to the state 1 appeared in *N. carolii and C. goeldii.* A single reversal appeared in *P. birabeni.* Due to the absence of this appendage in the specimens of *P. avrilensis* and *D. delamarei* analysed herein, these taxa present ambiguities in this character.

Character 72: Uropod, exopod, dimensions: (0) about 2x longer than wide; (1) about 2,5 x longer than wide; (2) about 3x or longer.
New character proposal.
(Figure 132)
L = 4, CI = 50, RI = 0

The primitive state of this character (state 2), also appeared as a reversal in *N. nanus.* The state 0 appeared independently three times in the cladogram in three reversals in *P. birabeni, P. loyolai and* in clade 12. A single reversal to the state 1 appeared in the clade 2 and this revealed to be a synapomorphy of this clade. Two ambiguities appeared in the cladogram (*P. avrilensis* and *D. delamarei*).

Character 73: Inner margin of uropod endopod, longitudinal row of long setae: (0) absent; (1) present.
New character proposal.
(Figure 133)
L = 6, CI = 16, RI = 37

This is also a new character proposal. In fact, a row of scale-setae can be observed on many Crinocheta (Schmidt 2002, 2003), but this character was not coded before in phylogeny studies. In the cladogram recovered herein, the state of character 0 is the primitive one, also appearing in four reversals (*T.* tomentosa, *Novamundoniscus* sp. 5, *P. loyolai* and in clade 19). Two reversals to the state 1 appeared in clades 5 and 22. There are two ambiguities for this character in the cladogram (*P. avrilensis* and *D. delamarei*).

**Discussion on clades and synapomorphies**

The cladistic analyses recovered a single tree with no polytomies (23 clades). However, these are preliminary results, due to the high number of homoplasies, few unambiguous synapomorphies and several reversals in the recovered cladogram. In fact, only ten synapomorphies that do not represent autapomorphies were obtained. All taxa considered as Dubioniscidae prior this work were grouped together in a single node, excluding *N. singularis* and including *P. loyolai*. The latter species, although cited by Schultz (1995) as one of the American *Phalloniscus* that should be reallocated in *Novamundoniscus*, he did not make the transference, or even explained the reason why. Other *Phalloniscus* species of the New World discussed herein and not reallocated in *Novamundoniscus* remained apart of the "Dubioniscidae clade".

On the first node, a dichotomy between *N. singularis* and the clade 2 was recovered. The proximity of *I. singularis* with *I. variegata* reinforces the possibility of reallocation of *N. singularis* to *Ischioscia*.

The clade 2 presents the major number of synapomorphies that does not represent autapomorphic characters. The character 1, ecological category (state 3, clinger) is widespread among the majority of the terminal taxa presenting this state of character. Reversals to the creeper or roller state are also inserted in clade 2 (for more details of the characters and their states, see above). The character 37, state 0 (Maxillule, outer branch, inner set of teeth with simple apex)

appears here, with reversals to states 1 (all cleft) and 2 (both simple and cleft present) in some clades and terminal taxa allocated herein. The character 51, state 0 (pereopod 1, carpus, sensorial seta with double-fringe apex shape) appears in clade 2, with reversals to all other four states of this character can be found beyond this clade. The state 72 (uropod exopod dimensions), about 2,5 x longer than wide (state 1), appears for the first time in clade 2, with all other states (0, 2 and 3) also present as reversals beyond clade 2.

The next clade with synapomorphies is clade 3. The character 18 (eyes disposition on cephalothorax in frontal view, state 0 (not protruding eyes) is common to all terminal taxa that belong to clade 1. The protruding eyes is a synaphomorphy of *Ischioscia* (Leistikow & Schmidt 2002) and may be evoluted independently in *P. punctatus.* A revision of the *Phalloniscus* of New Zealand is necessary to verify if it is a character common to other *Phallonicus* of that country, considered the endemism zone of the genus. The other synapomorphic character in clade 3 is the character 19 in state 0 (antennule bearing no setae on medial article), with no reversals. Again, the analyses of other *Phalloniscus* are necessary to verify if this character is common to others New Zealand *Phalloniscus* or exclusive to *P. punctatus.*

The clade 5 presents two synapomorphies. The character 2, state 0 (fan-shaped scale setae on dorsal surface) is common to all terminal taxa herein, with a single reversal in *N. nanus* to state 1 (trichorn setae). The overall shape of both types of setae varies among Oniscidea species, what makes difficult a more detailed codification of this characters, generating a multistate character with too many states of character. As cited in the discussion of the characters, the presence of *noduli laterales* (character 3, state 0) occurs in all terminal taxa with fan-shaped scale setae and this character state is a synapomorphy of clade 5, but with no reversals among the taxa that belong to this clade.

The clade 10 can be considered the "Dubioniscidae" clade herein. As cited before, *N singularis* is the only species allocated in this family that is apart of this clade and this also corroboraes that *P. loyolai and P. setosus* may be, in fact, Dubioniscidae taxa. However, there is a single synapomorphy for this clade, character 40, state 0 (maxilliped distal article with individual setae), with no reversals. This is a character present in the diagnosis of Dubioniscidae that the cladogram corroborates.

Although the phylogenetic analyses herein resulted in a weak cladogram, the Dubioniscidae clade, with exception of *N. singularis*, remains monophyletic. So, some putative assumptions can be made. The monophyly of *Novamundoniscus* was not recovered. The clade 11 suggests that, the taxa

allocated there must be analysed with *Dubioniscus* altogether, to verify the possibility of allocation of all species inside clade 11 in the referred genus in future works. Along with *Phalloniscus loyolai* (presumed to be a *Novamundoniscus* species prior this work), there is another genus of Dubioniscidae among the terminal taxa of clade 16, *Calycuoniscus.* Once this genus, represented herein by *C. goeldii*, is anterior to the description of *Novamundoniscus*, the results suggests the combination of all species of clade 16 in *Calycuoniscus*. This demands a full revision of all species that compounds this genus and, if possible, the acquisition of missing *Novamundoniscus* to a more precise diagnosis of the supracited taxa, in order to determine if they both constitutes, together, a single genus.

## CONSIDERAÇÕES FINAIS

Este é o primeiro estudo a buscar soluções para a filogenia de *Novamundoniscus*. A falta de alguns táxons pertencentes a este gênero reduziu a possibilidade de uma conclusão final sobre as relações entre todas as espécies de *Novamundoniscus*. Não foi encontrado o tipo de *N. marcuzzi* (Vandel, 1952). Um único indivíduo, depositado no Museu Nacional do Rio de Janeiro, foi analisado, e certamente não pertence a esta espécie. Além disso, é uma fêmea e sua identificação não foi possível. Outra espécie ausente no presente estudo é *N. persimilis* (Vandel, 1952), que também precisa ser analisada em trabalhos futuros, caso seja encontrado o tipo ou novos exemplars desta espécie sejam obtidos, a fim de solucionar algumas questões sobre a filogenia deste grupo. O gênero *Novamundoniscus* foi elencado para alocar as espécies americanas de *Phalloniscus*. O único indivíduo de *P. barbouri* (Van Name, 1926), o holótipo, pôde ser analisado, mas este indivíduo não foi incluído neste estudo. É uma fêmea e o espécime está mal preservado. No presente trabalho, *Novamundoniscus* não pôde ser confirmado como um táxon válido, e os resultados obtidos, ainda que parciais para a filogenia, indicam que as espécies aqui abordadas talvez devessem ser realocadas em *Dubioniscus* ou *Calycuoniscus*, ou mesmo em novos gêneros.

Contudo, algumas conclusões interessantes podem ser obtidas. *N. singularis*, aparentemente, não pertence a Dubioniscidae. Seus caracteres permitem realocar esta espécie no gênero *Ischioscia*, como pode ser vista em sua redescrição. Lemos de Castro (1967) observou que esta espécie tem mais em comum com este último gênero do que com o *Phalloniscus*. Outras espécies de *Phalloniscus* que não foram analisados por Schultz (1995) quando ele criou o gênero *Novamundoniscus* puderam ser verificadas durante este estudo. *Phalloniscus pearsei* revelou-se pertencer a outra família, ainda a ser confirmada. O mesmo acontece com *P. langi*, que tem relações mais próximas com outras espécies de Crinochaeta, provavelmente pertencentes a Philosciidae. Uma espécie brasileira de *Phalloniscus* que não foi também estudada por Schultz, *P. loyolai*, poderia ser revisada e ser realocada para Dubioniscidae. Também continua dúbia a posição taxonômica de *P. avrilensis*.

Apesar de algumas espécies de *Novamundoniscus* e de *Phalloniscus* das Américas não estarem disponíveis, este estudo pode ser usado como base para determinar a real relação destes com Dubioniscidae. Entretanto, somente após análises cladísticas mais refinadas com todas as espécies pertencentes a Dubioniscidae, se possível, um resultado mais preciso pode ser obtido. Assim, futuros estudos que pretendam resolver as relações entre os taxa que compõem Dubioniscidae devem incluir os gêneros *Dubioniscus* e *Calycuoniscus*, além de outros *Phalloniscus* indisponíveis durante a realização deste trabalho. De qualquer forma, a falta de caracteres

suficientes para uma diagnose completa de *Novamundoniscus* sugere que este gênero talvez não constitua um táxon natural. Uma análise molecular, que também não foi possível no presente trabalho, faz-se necessária para refinar futuras análises deste gênero e de suas relações com outros Dubioniscidae e Crinochaeta.

Embora *Novamundoniscus* não tenha se confirmado como um táxon monofilético, o presente estudo revelou que Dubioniscidae, provavelmente, o é. A inclusão de *P. loyolai* em Dubioniscidae, as realocações de *N. singularis* para *Ischioscia* e de *N. gracilis* para *Dubioniscus* parecem plausíveis com base na taxonomia destas duas espécies e dos gêneros para os quais foram realocadas.

A decisão final, após este estudo, é manter o gênero *Novamundoniscus*, mesmo que seja aparantemente parafilético. Além disso, devido às similaridades entre as espécies de Dubioniscidae, especialmente as espécies brasileiras, Dubioniscidae deve ser mantido como um grupo natural e monofilético, como previsto por Shultz (1995).

Os resultados da analise filogenética aqui apresentada são considerados provisórios, e como tal, as implicações taxonômicas da topologia discutida não foram adotadas na revisão de *Novamundoniscus*. Contudo, as otimizações dos caracteres nesta topologia fornecem conclusões importantes para o entendimento da história evolutiva dos táxons analisados e a matriz de caracteres proporciona uma base sólida para a continuidade desta linha de pesquisa.

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Table 1. Character matrix. Characters 1 to 11.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| *Ischioscia variegata* | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Nagurus nanus* | 3 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| *Neotroponiscus carolii* | 3 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 |
| *Trichorhina tomentosa* | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| *Pudeoniscus birabeni* | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Phalloniscus punctatus* | 3 | 1 | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 |
| *Phalloniscus avrilensis* | 3 | 1 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| *Phalloniscus setosus* | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Phalloniscus loyolai* | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| *Phalloniscus langi* | 3 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Phalloniscus pearsei* | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| *Dubioniscus delamarei* | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Calycuoniscus goeldii* | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus vandeli* | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus gracilis* | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus dissimilis* | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus macrophthalmus* | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus singularis* | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus altamiraensis* | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 2 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 3 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 4 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 5 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ? | 0 |

Table 2. Character matrix (continuation). Characters 12 to 22.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| *Ischioscia variegata* | 0 | 0 | - | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 2 |
| *Nagurus nanus* | - | 1 | 1 | 1 | 1 | - | 0 | 0 | 6 | 0 | 2 |
| *Neotroponiscus carolii* | - | 1 | 2 | 1 | 1 | - | 0 | 0 | 0 | 0 | 2 |
| *Trichorhina tomentosa* | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| *Pudeoniscus birabeni* | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 4 | 0 | 0 |
| *Phalloniscus punctatus* | - | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 5 | 0 | 2 |
| *Phalloniscus avrilensis* | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| *Phalloniscus setosus* | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 |
| *Phalloniscus loyolai* | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| *Phalloniscus langi* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 |
| *Phalloniscus pearsei* | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 2 |
| *Dubioniscus delamarei* | 0 | 1 | 1 | 0 | 1 | - | 0 | 0 | 0 | 0 | 2 |
| *Calycuoniscus goeldii* | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Novamundoniscus vandeli* | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 2 | 0 | 1 |
| *Novamundoniscus gracilis* | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 2 | 1 | 2 |
| *Novamundoniscus dissimilis* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| *Novamundoniscus macrophthalmus* | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Novamundoniscus singularis* | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 3 | 0 | 2 |
| *Novamundoniscus altamiraensis* | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| *Novamundoniscus* n. sp. 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| *Novamundoniscus* n. sp. 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| *Novamundoniscus* n. sp. 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 |
| *Novamundoniscus* n. sp. 5 | 0 | 1 | 0 | 0 | 1 | - | 0 | 0 | 2 | 1 | 2 |
| *Novamundoniscus* n. sp. 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 |

Table 3. Character matrix (continuation). Characters 23 to 33.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
| *Ischioscia variegata* | 1 | 0 | 0 | ? | ? | ? | ? | ? | ? | 1 | 0 |
| *Nagurus nanus* | 1 | 2 | - | ? | - | - | - | - | - | 1 | 1 |
| *Neotroponiscus carolii* | 2 | 2 | - | - | - | - | - | - | - | 0 | 1 |
| *Trichorhina tomentosa* | 0 | 2 | - | - | - | - | - | - | - | 1 | 0 |
| *Pudeoniscus birabeni* | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 0 | 2 | 1 | 0 |
| *Phalloniscus punctatus* | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 0 | 1 | 1 | 0 |
| *Phalloniscus avrilensis* | 1 | 0 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| *Phalloniscus setosus* | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| *Phalloniscus loyolai* | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Phalloniscus langi* | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| *Phalloniscus pearsei* | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| *Dubioniscus delamarei* | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 3 | 4 | 1 | 0 |
| *Calycuoniscus goeldii* | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus vandeli* | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| *Novamundoniscus gracilis* | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| *Novamundoniscus dissimilis* | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| *Novamundoniscus macrophthalmus* | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus singularis* | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 1 | 0 |
| *Novamundoniscus altamiraensis* | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 3 | 1 | 0 |
| *Novamundoniscus* n. sp. 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 2 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 3 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 4 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| *Novamundoniscus* n. sp. 5 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 6 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |

Table 4. Character matrix (continuation). Characters 34 to 44.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |
| *Ischioscia variegata* | 1 | 2 | 0 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| *Nagurus nanus* | 2 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| *Neotroponiscus carolii* | 2 | 2 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| *Trichorhina tomentosa* | 0 | 1 | 0 | 2 | 0 | 3 | 1 | 1 | 0 | 1 | 1 |
| *Pudeoniscus birabeni* | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| *Phalloniscus punctatus* | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 |
| *Phalloniscus avrilensis* | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| *Phalloniscus setosus* | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Phalloniscus loyolai* | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| *Phalloniscus langi* | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 1 |
| *Phalloniscus pearsei* | 2 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 1 | 0 |
| *Dubioniscus delamarei* | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Calycuoniscus goeldii* | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus vandeli* | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus gracilis* | 1 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Novamundoniscus dissimilis* | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Novamundoniscus macrophthalmus* | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus singularis* | 1 | 2 | 0 | 2 | 0 | 3 | 1 | 1 | 1 | 0 | 1 |
| *Novamundoniscus altamiraensis* | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 3 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 4 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Novamundoniscus* n. sp. 5 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 5. Character matrix (continuation). Characters 45 to 55.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 |
| *Ischioscia variegata* | 1 | 0 | 0 | 2 | 3 | 1 | 4 | 0 | 0 | 0 | 2 |
| *Nagurus nanus* | 2 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Neotroponiscus carolii* | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| *Trichorhina tomentosa* | 2 | 1 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| *Pudeoniscus birabeni* | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 0 | 0 | 1 | 2 |
| *Phalloniscus punctatus* | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 2 |
| *Phalloniscus avrilensis* | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Phalloniscus setosus* | 1 | 1 | 1 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 2 |
| *Phalloniscus loyolai* | 1 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 1 | 1 | 0 |
| *Phalloniscus langi* | 1 | 0 | 0 | 2 | 3 | 0 | 4 | 0 | 0 | 0 | 1 |
| *Phalloniscus pearsei* | 0 | 0 | 1 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Dubioniscus delamarei* | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Calycuoniscus goeldii* | 2 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Novamundoniscus vandeli* | 2 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 1 |
| *Novamundoniscus gracilis* | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 2 |
| *Novamundoniscus dissimilis* | 0 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus macrophthalmus* | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Novamundoniscus singularis* | 1 | 1 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 1 |
| *Novamundoniscus altamiraensis* | 2 | 0 | 1 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 1 | 1 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 2 | 2 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 3 | 0 | 1 | 1 | 0 | 2 | 1 | 2 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 4 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 5 | 1 | 1 | 1 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 6 | 1 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 2 |

Table 6. Character matrix (continuation). Characters 56 to 66.

| TAXA | CHARACTERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 |
| *Ischioscia variegata* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| *Nagurus nanus* | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Neotroponiscus carolii* | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Trichorhina tomentosa* | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Pudeoniscus birabeni* | 0 | 0 | 1 | 4 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| *Phalloniscus punctatus* | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| *Phalloniscus avrilensis* | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Phalloniscus setosus* | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| *Phalloniscus loyolai* | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Phalloniscus langi* | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| *Phalloniscus pearsei* | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| *Dubioniscus delamarei* | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Calycuoniscus goeldii* | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| *Novamundoniscus vandeli* | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| *Novamundoniscus gracilis* | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| *Novamundoniscus dissimilis* | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| *Novamundoniscus macrophthalmus* | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| *Novamundoniscus singularis* | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| *Novamundoniscus altamiraensis* | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Novamundoniscus* n. sp. 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| *Novamundoniscus* n. sp. 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| *Novamundoniscus* n. sp. 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| *Novamundoniscus* n. sp. 4 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 5 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| *Novamundoniscus* n. sp. 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

Table 7. Character matrix (continuation). Characters 67 to 73.

| TAXA | CHARACTERS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 67 | 68 | 69 | 70 | 71 | 72 | 73 |
| *Ischioscia variegata* | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| *Nagurus nanus* | 0 | 0 | 1 | 0 | 0 | 2 | 1 |
| *Neotroponiscus carolii* | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| *Trichorhina tomentosa* | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| *Pudeoniscus birabeni* | 1 | 0 | 0 | 0 | 2 | 0 | 1 |
| *Phalloniscus punctatus* | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| *Phalloniscus avrilensis* | 0 | 0 | 0 | 1 | ? | ? | ? |
| *Phalloniscus setosus* | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| *Phalloniscus loyolai* | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| *Phalloniscus langi* | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| *Phalloniscus pearsei* | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| *Dubioniscus delamarei* | 1 | 0 | 0 | 1 | ? | ? | ? |
| *Calycuoniscus goeldii* | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| *Novamundoniscus vandeli* | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| *Novamundoniscus gracilis* | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Novamundoniscus dissimilis* | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| *Novamundoniscus macrophthalmus* | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| *Novamundoniscus singularis* | 1 | 0 | 1 | 1 | 0 | 2 | 0 |
| *Novamundoniscus altamiraensis* | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 2 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 3 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| *Novamundoniscus* n. sp. 4 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Novamundoniscus* n. sp. 5 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| *Novamundoniscus* n. sp. 6 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |

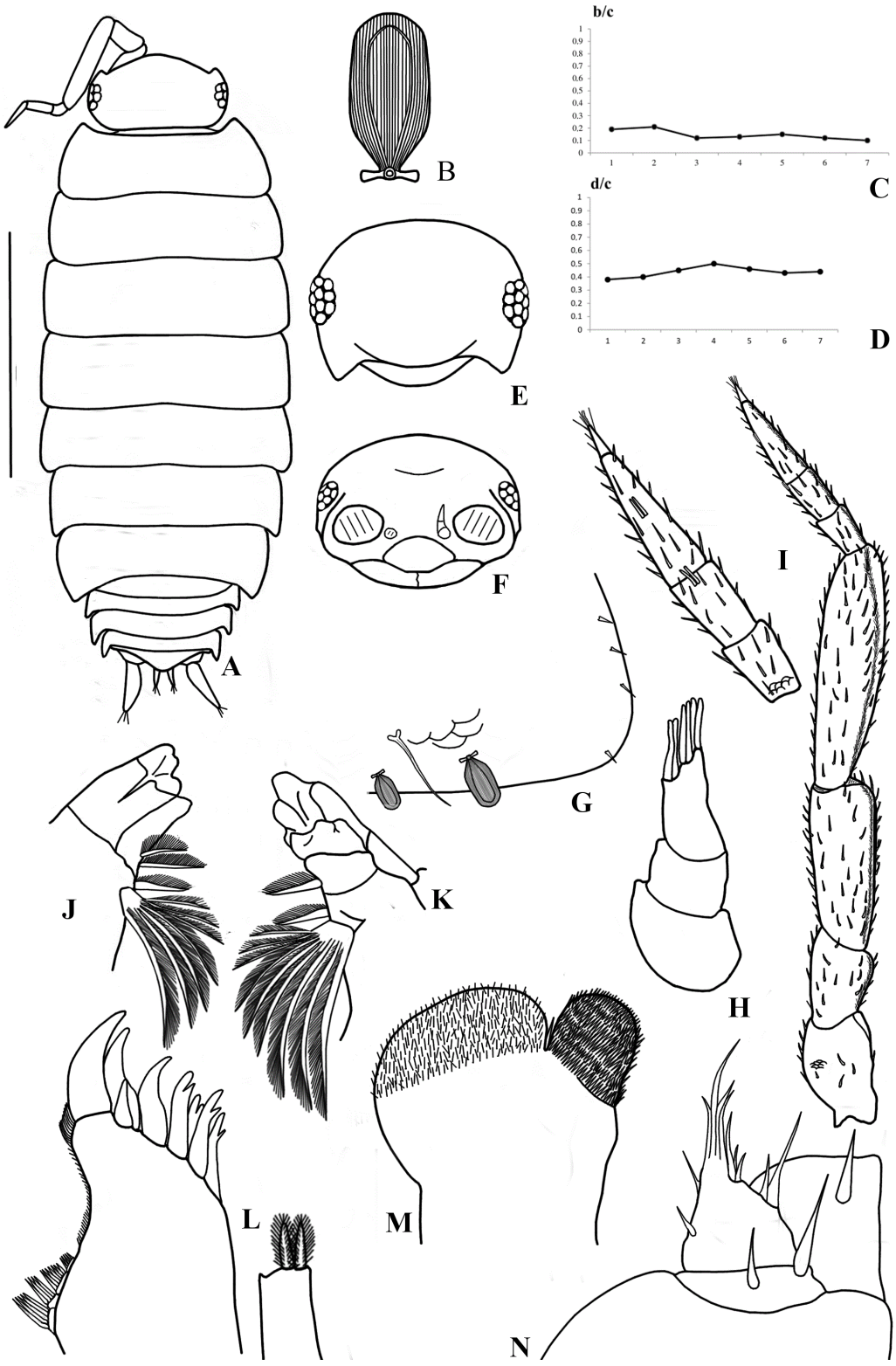


Figure 1. *Novamundoniscus vandeli* (Lemos de Castro, 1960), male, paratype MNRJ 6162. A, *habitus*; B, fan-shaped scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 6; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

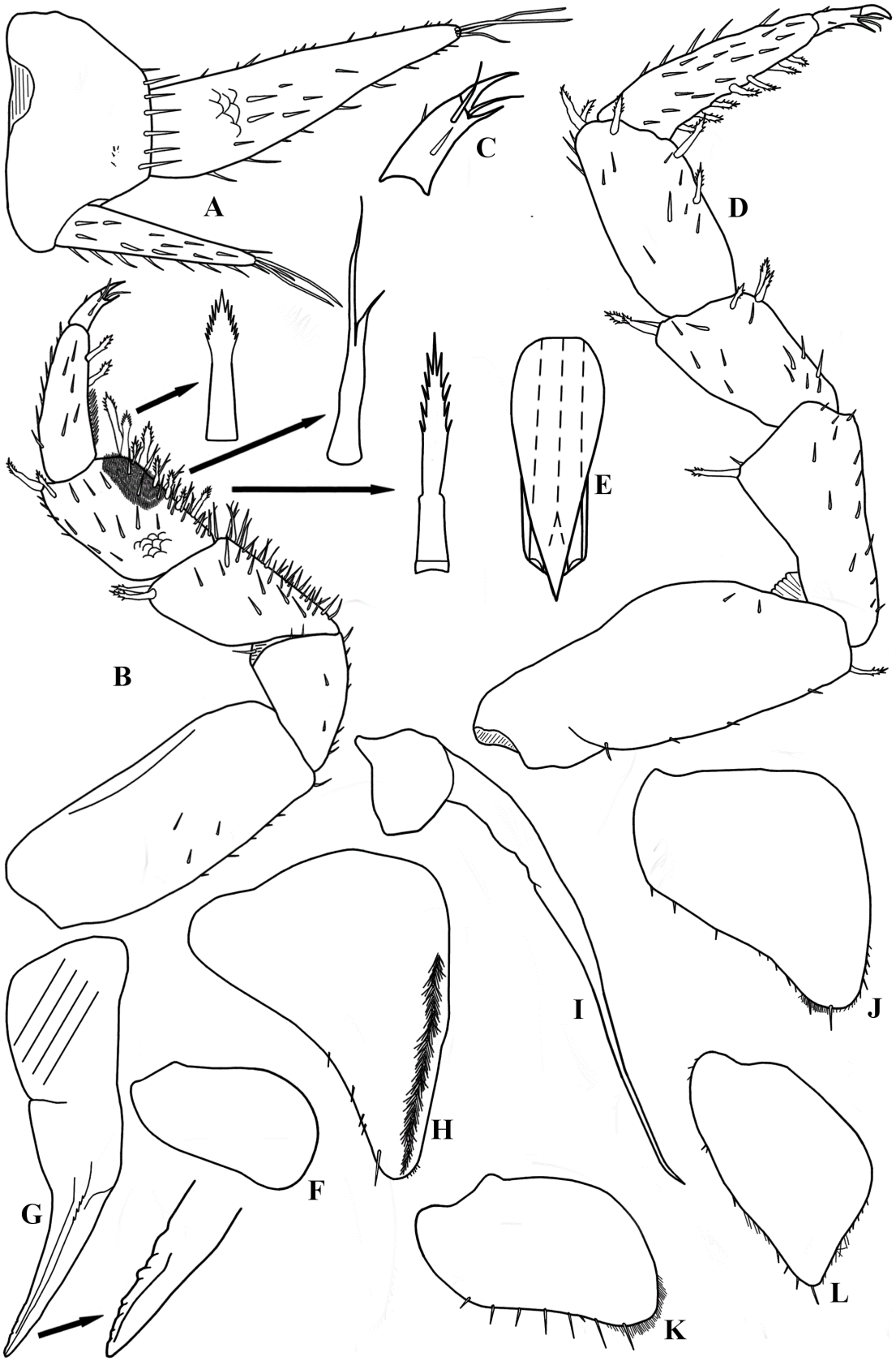


Figure 2. *Novamundoniscus vandeli* (Lemos de Castro, 1960), male, paratype MNRJ 6162. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

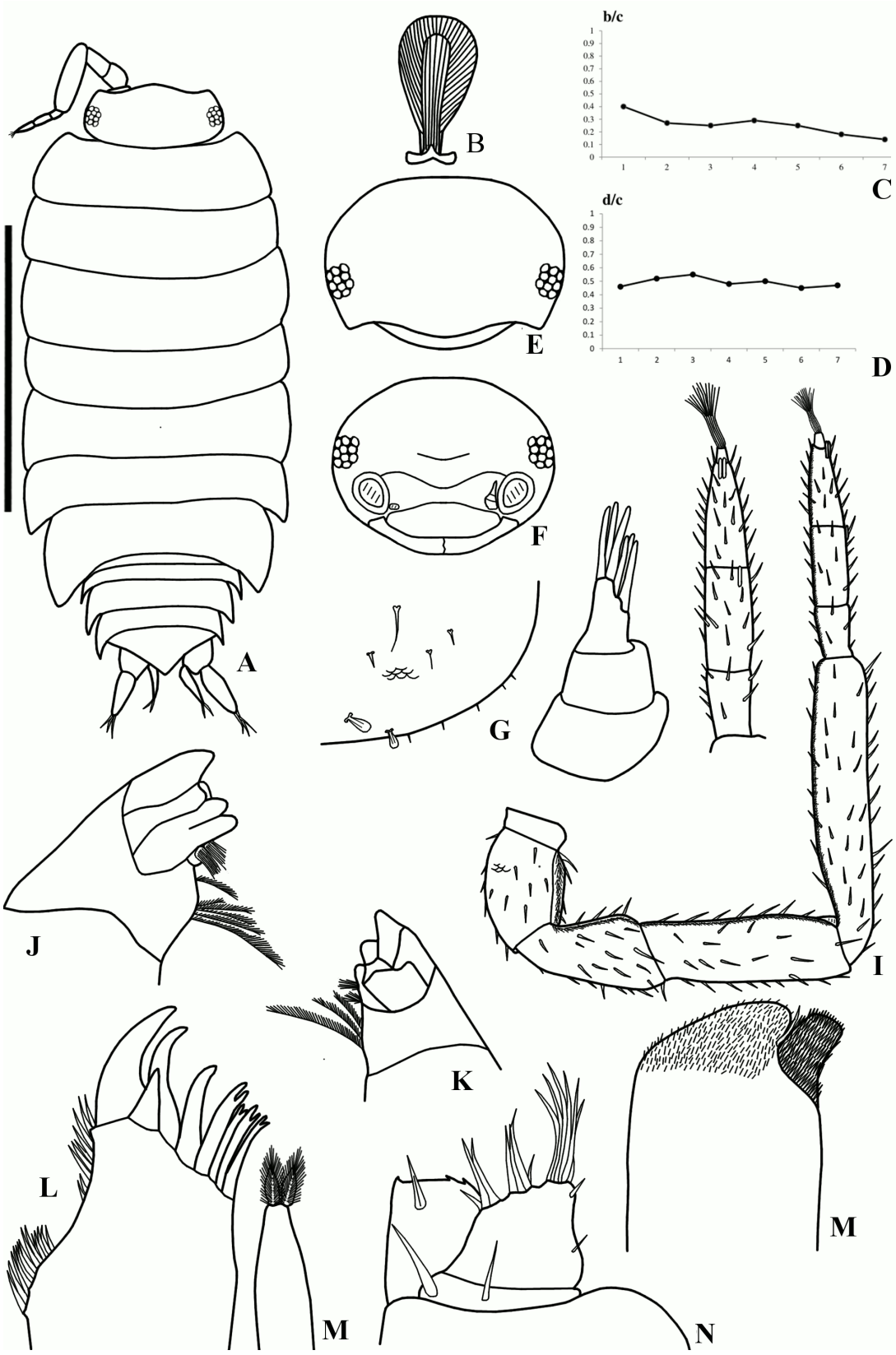


Figure 3. *Novamundoniscus dissimilis* (Lemos de Castro, 1960), male, paratype MNRJ 6165. A, *habitus*; B, fan-shaped scale seta; C, b/c *noduli laterales* coordinates; D, d/c nodulilaterales coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 6; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

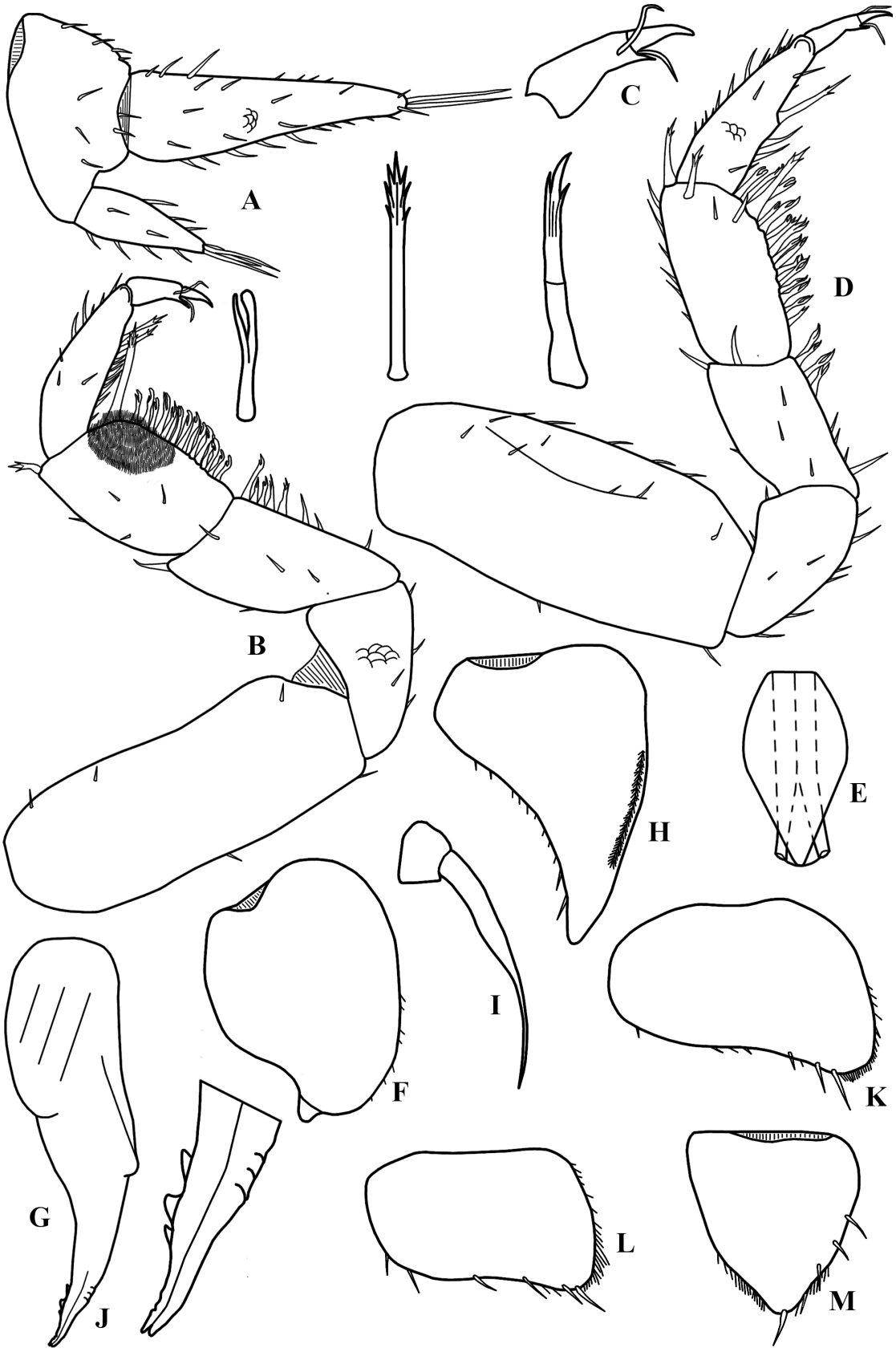


Figure 4. *Novamundoniscus dissimilis* (Lemos de Castro, 1960), male, paratype MNRJ 6165. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

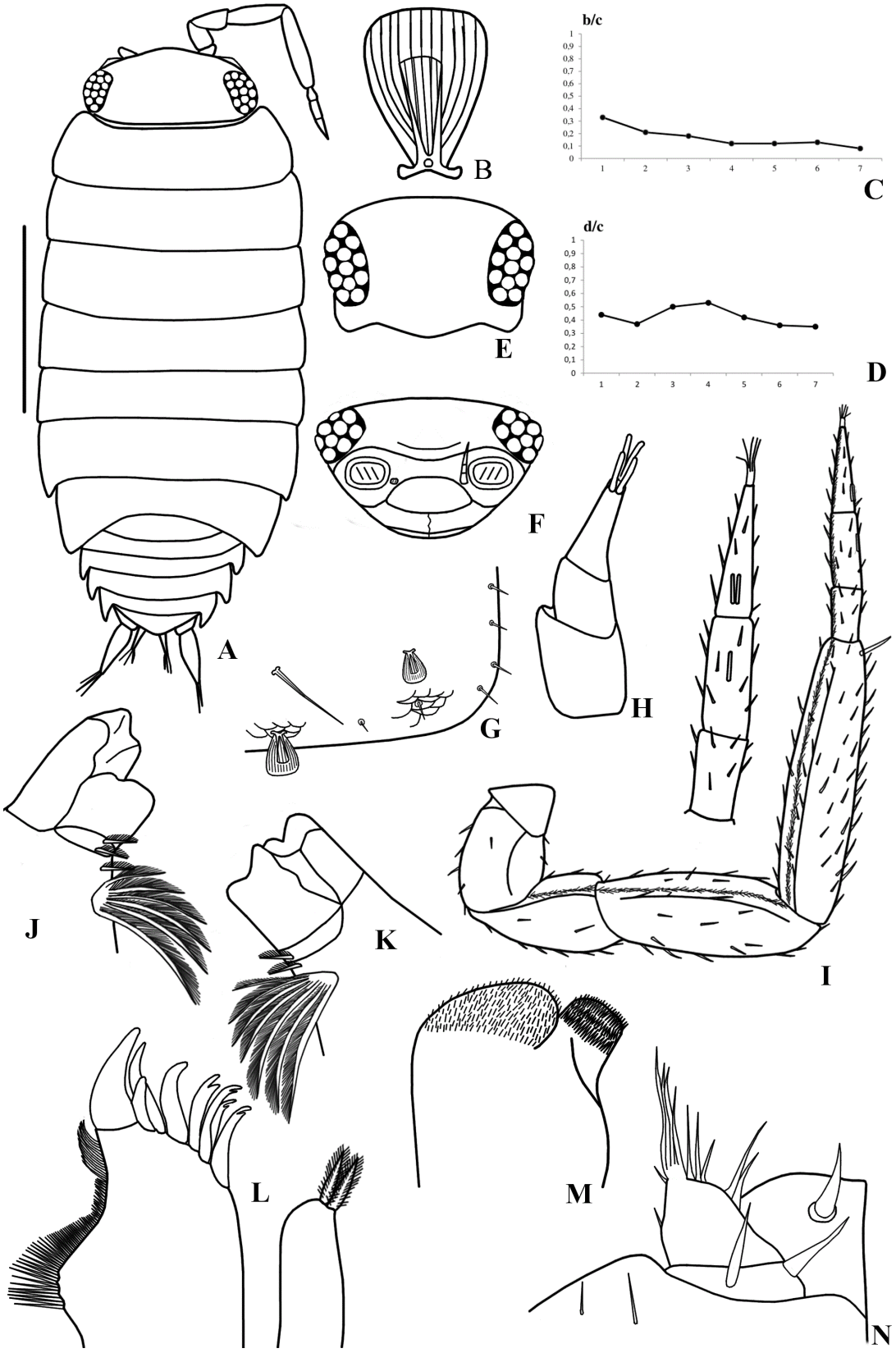


Figure 5. *Novamundoniscus macrophtalmus* (Lemos de Castro, 1960), male, paratype MNRJ 6159. A, *habitus*; B, fan-shaped scale seta; C, b/c *noduli laterales* coordinates; D, d/c nodulilaterales coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 6; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

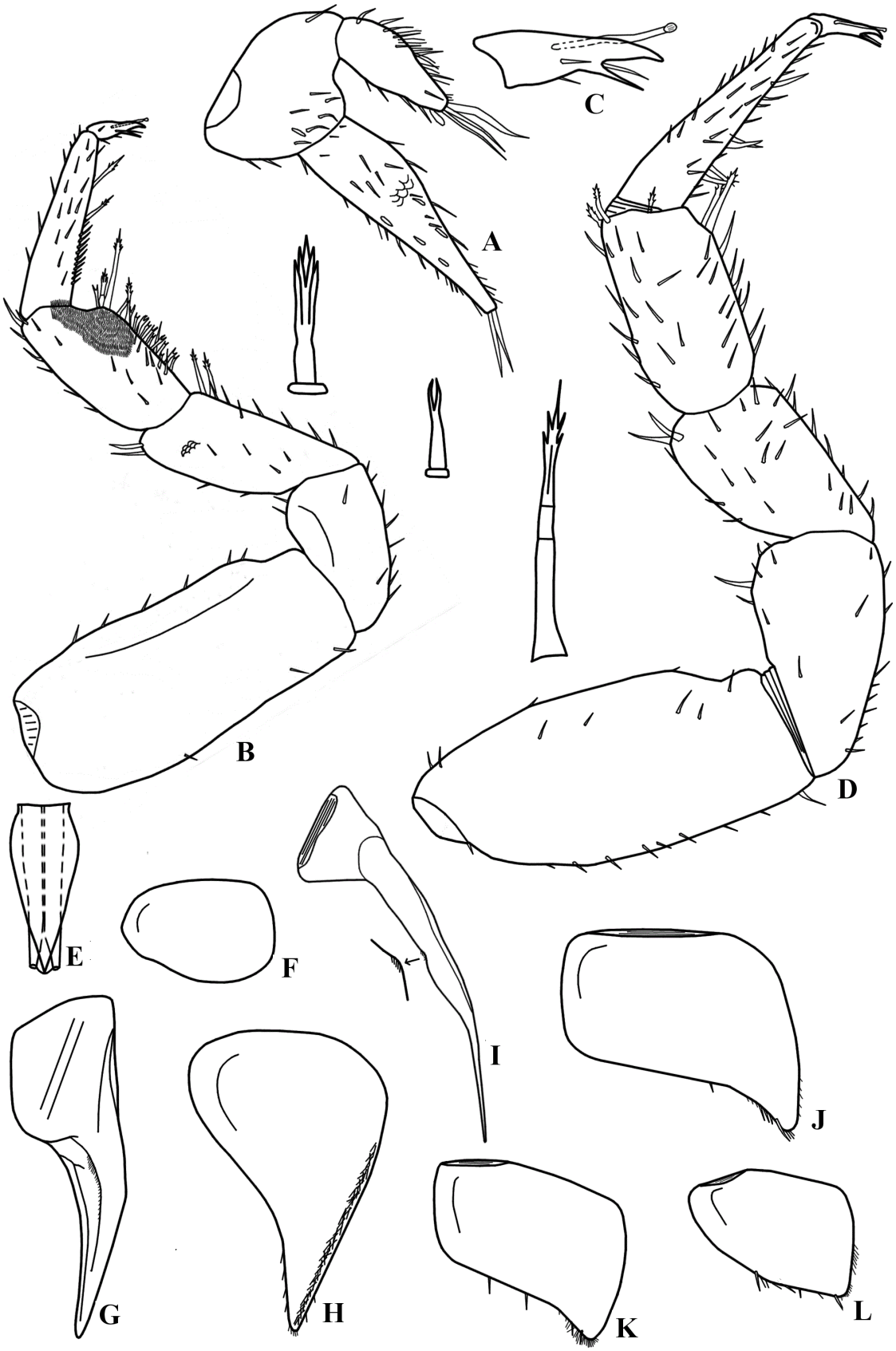


Figure 6. *Novamundoniscus macrophtalmus* (Lemos de Castro, 1960), male, paratype MNRJ 6159. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

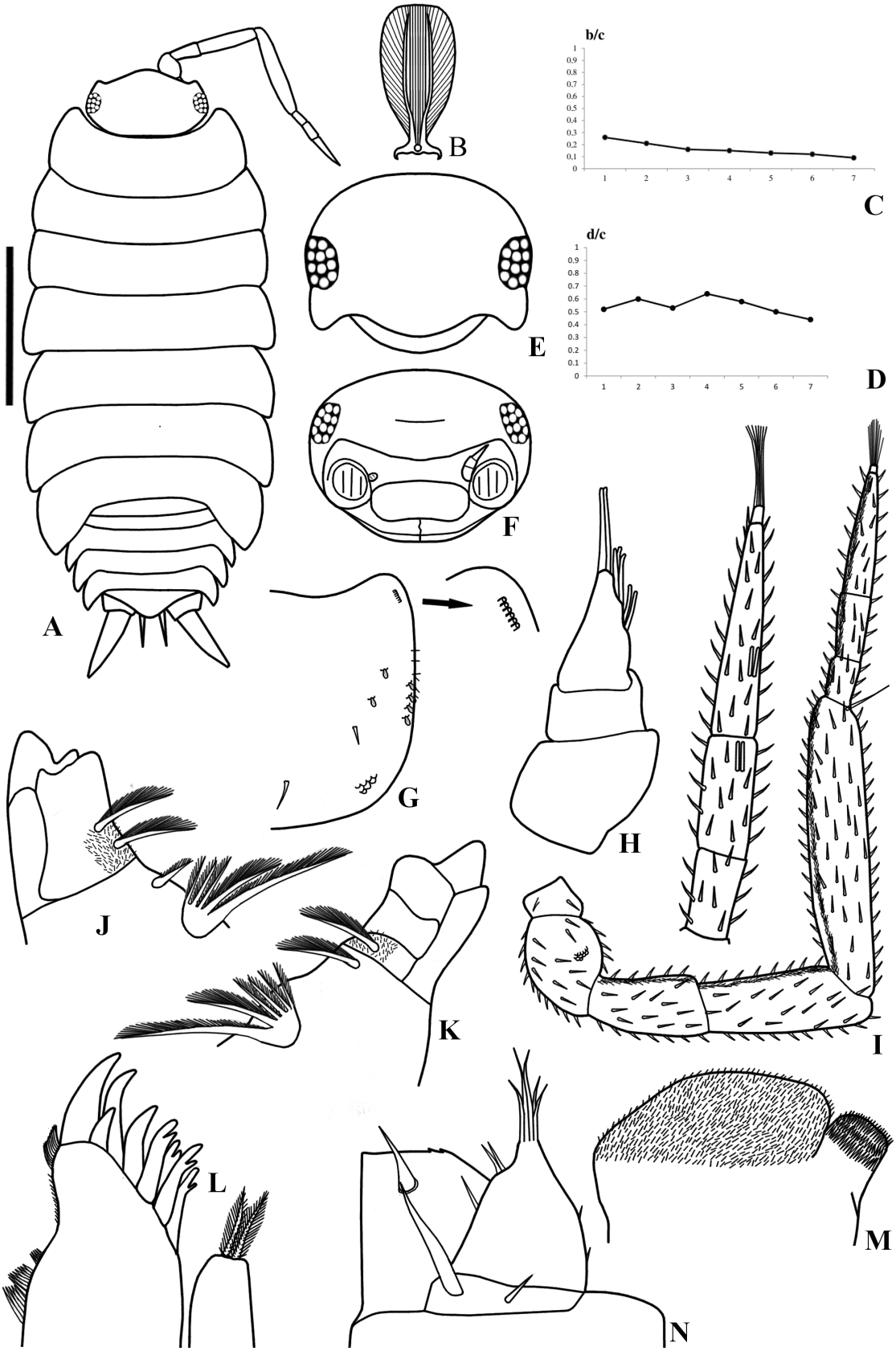


Figure 7. *Novamundoniscus setosus* (Lemos de Castro, 1960) n. comb, male, additional material examinedMNRJ 3061. A, *habitus*; B, fan-shaped scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron 6; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

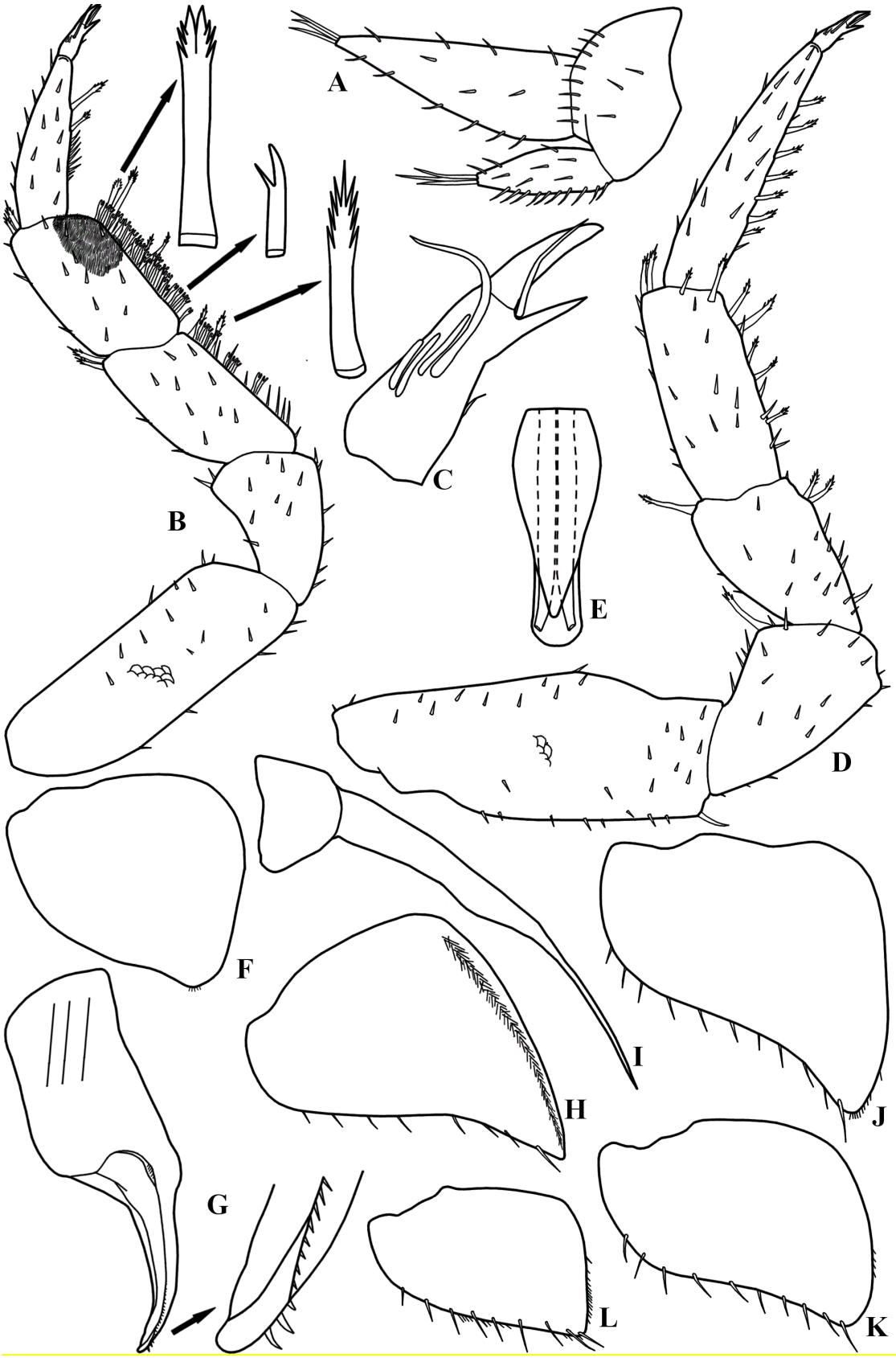


Figure 8. *Novamundoniscus setosus* (Lemos de Castro, 1960) n. comb, male, additional material examined MNRJ 3061. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.


Figure 9. *Ischioscia singularis* (Lemos de Castro, 1967) n. comb., male, additional material examined MNRJ 3061. A, *habitus*; B, fan-shaped scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron 6; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

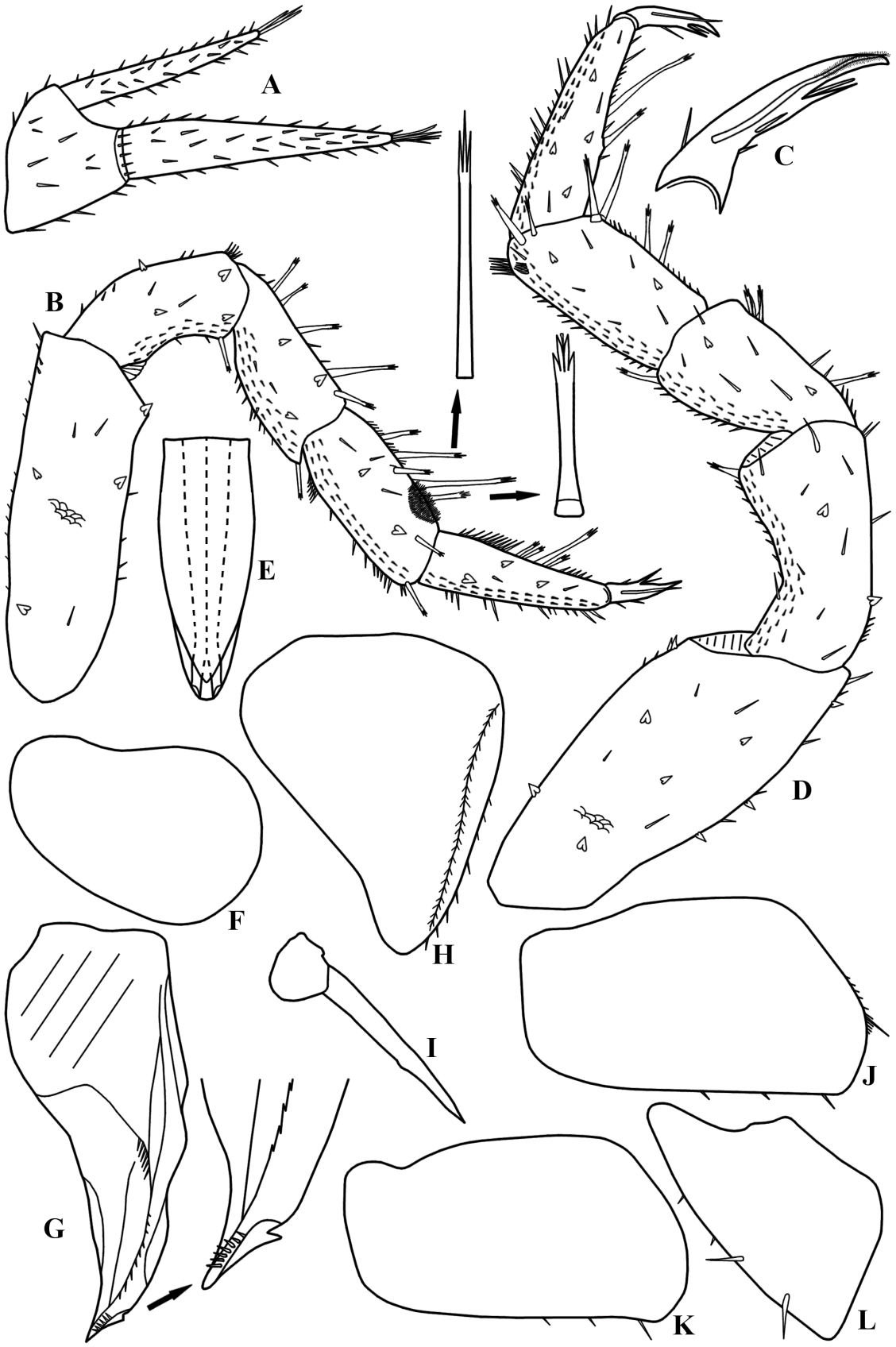


Figure 10. *Ischioscia singularis* (Lemos de Castro, 1967) n. comb., male, additional material examined MNRJ 3061.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

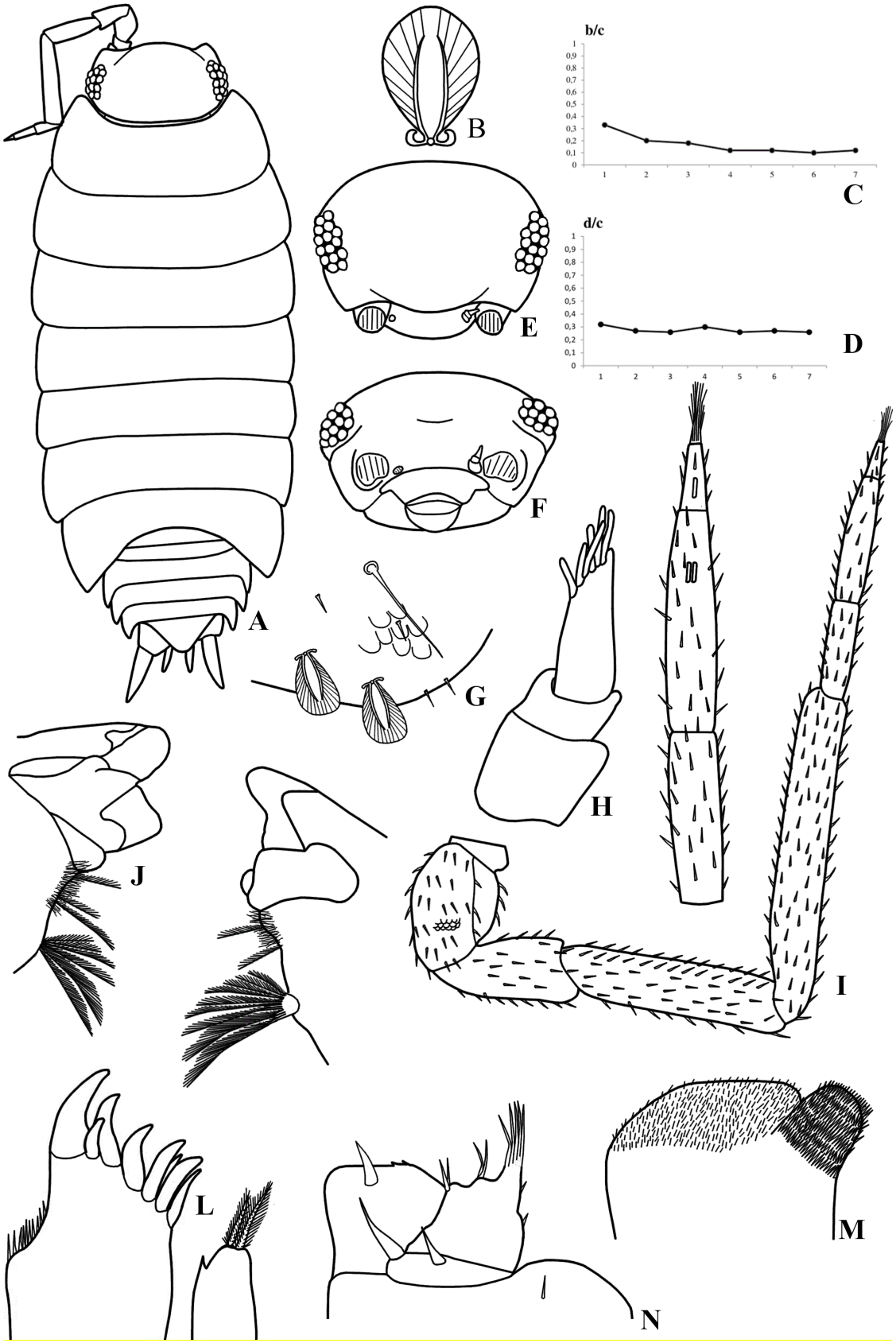


Figure 11. *Dubioniscus gracilis* Lopes e Araujo, 2003, male, paratype UFRGS 3627. A, *habitus*; B, fan-shaped scale seta; C, b/c *noduli laterales* coordinates; D, d/c nodule laterales coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 6; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

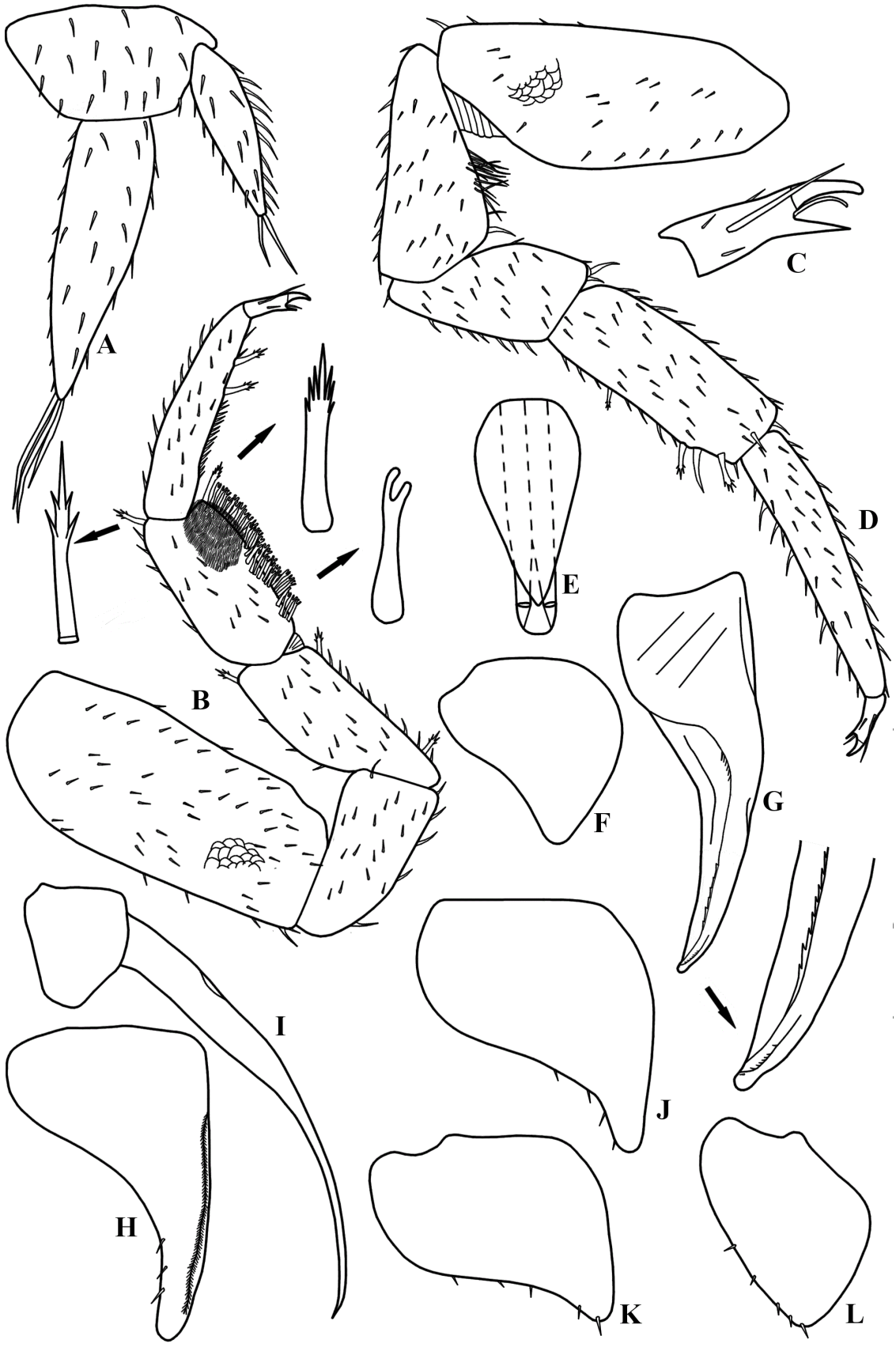


Figure 12. *Dubioniscus gracilis* Lopes e Araujo, 2003, male, paratype UFRGS 3627. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

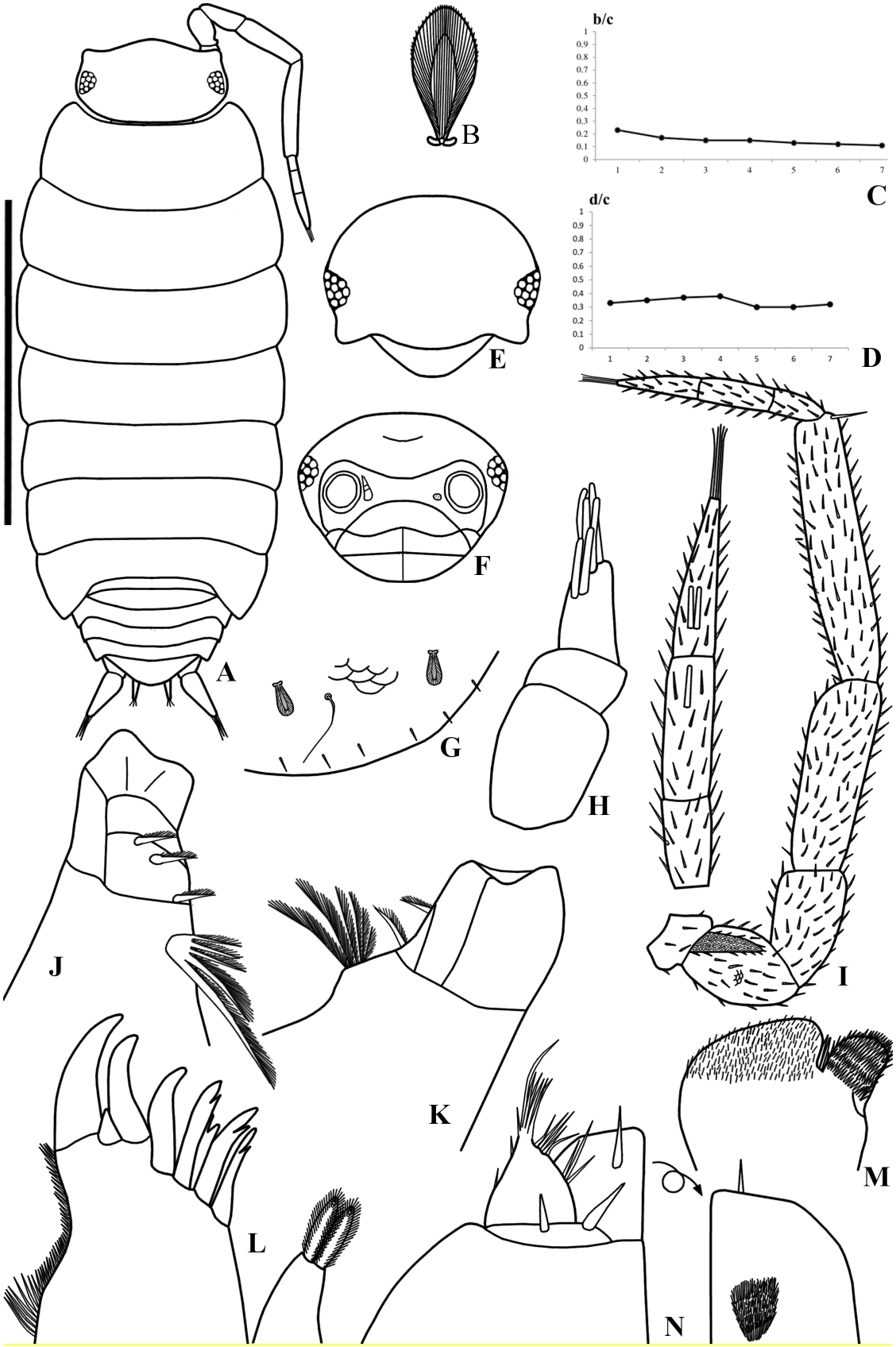


Figure 13. *Novamundoniscus* sp. 1, male, paratype UFRGS 6388. A, *habitus*; B, fan-shapedscale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, dorsal view; F, cephalothorax, frontal view; G, epimeron 1; H, antennula; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

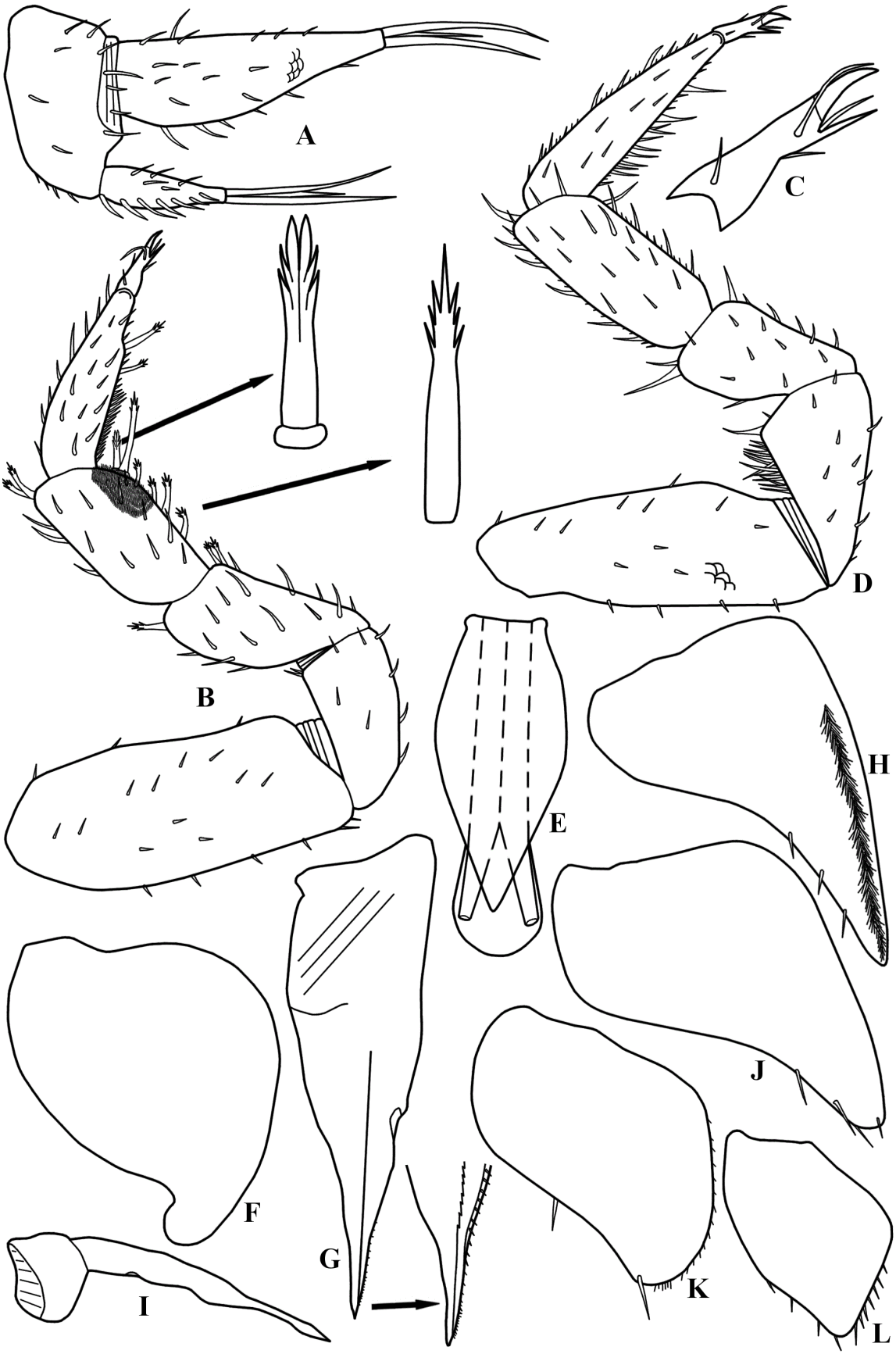


Figure 14. *Novamundoniscus* sp. 1, male, paratype UFRGS 6388. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

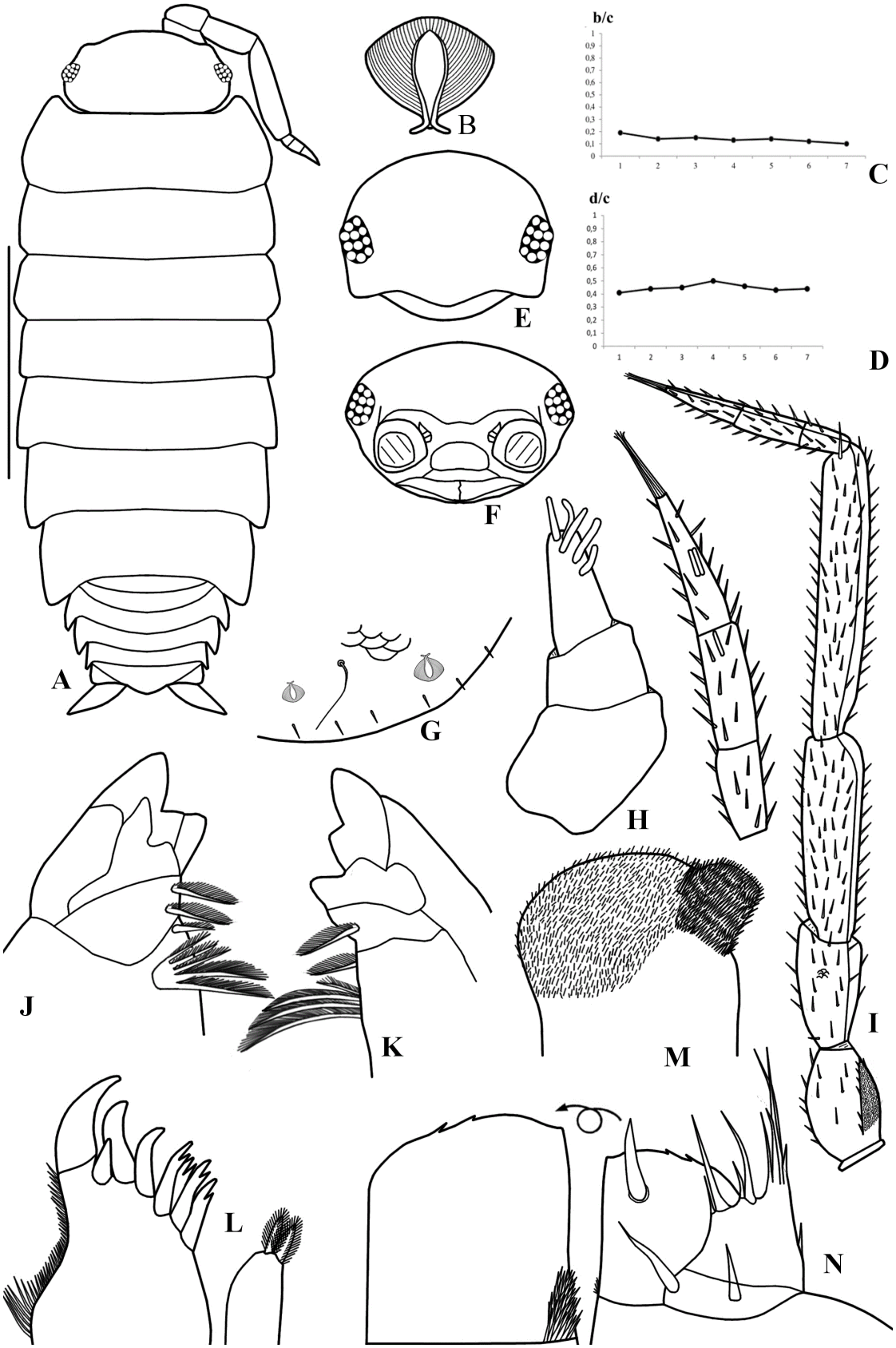


Figure 15. *Novamundoniscus* sp. 2, male, paratype UFRGS 4461. A, *habitus*; B, fan-shapedscale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, dorsal view; F, cephalothorax, frontal view; G, epimeron 1; H, antennula; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

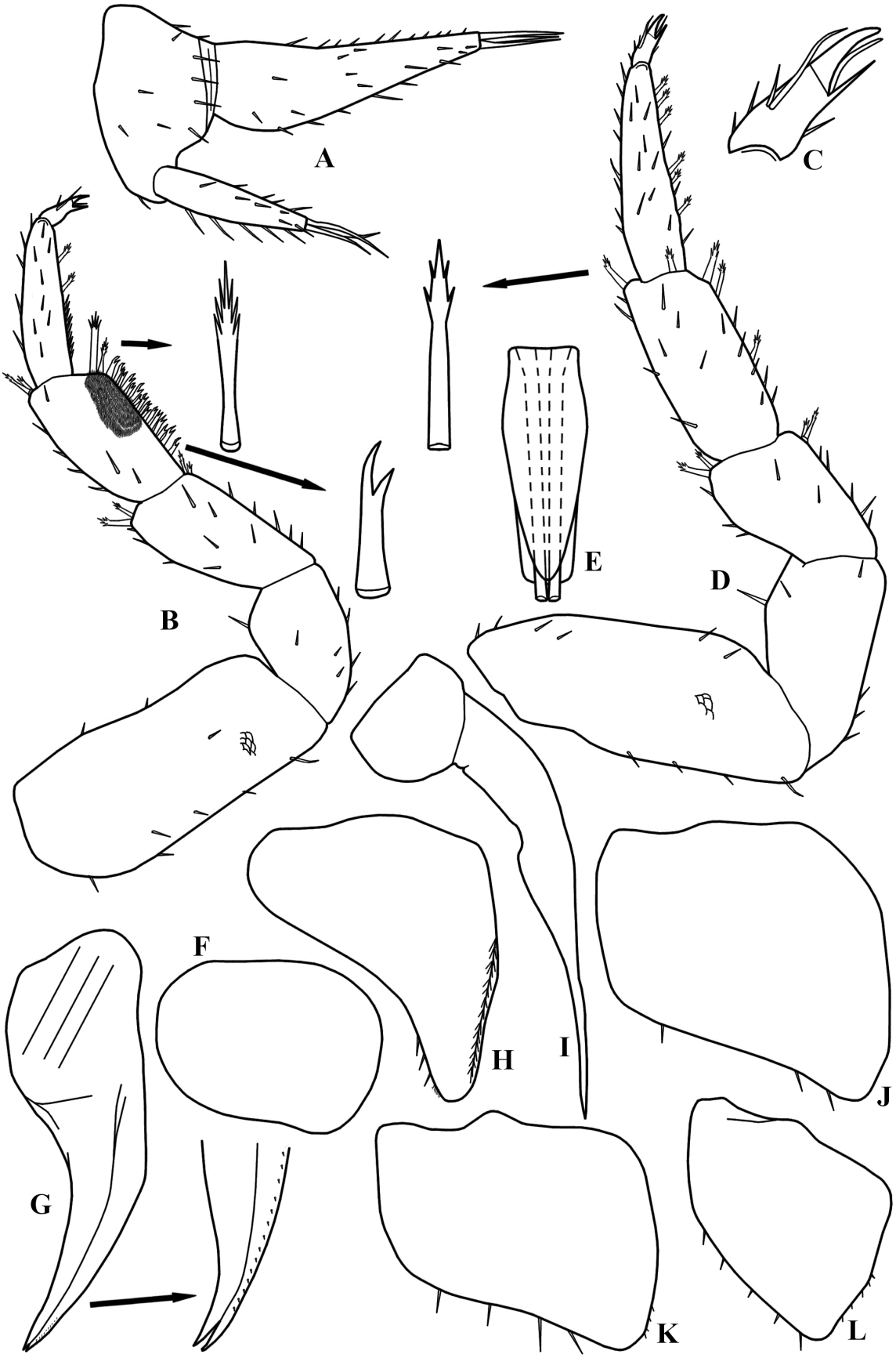


Figure 16. *Novamundoniscus* sp. 2, male, paratype UFRGS 4461. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

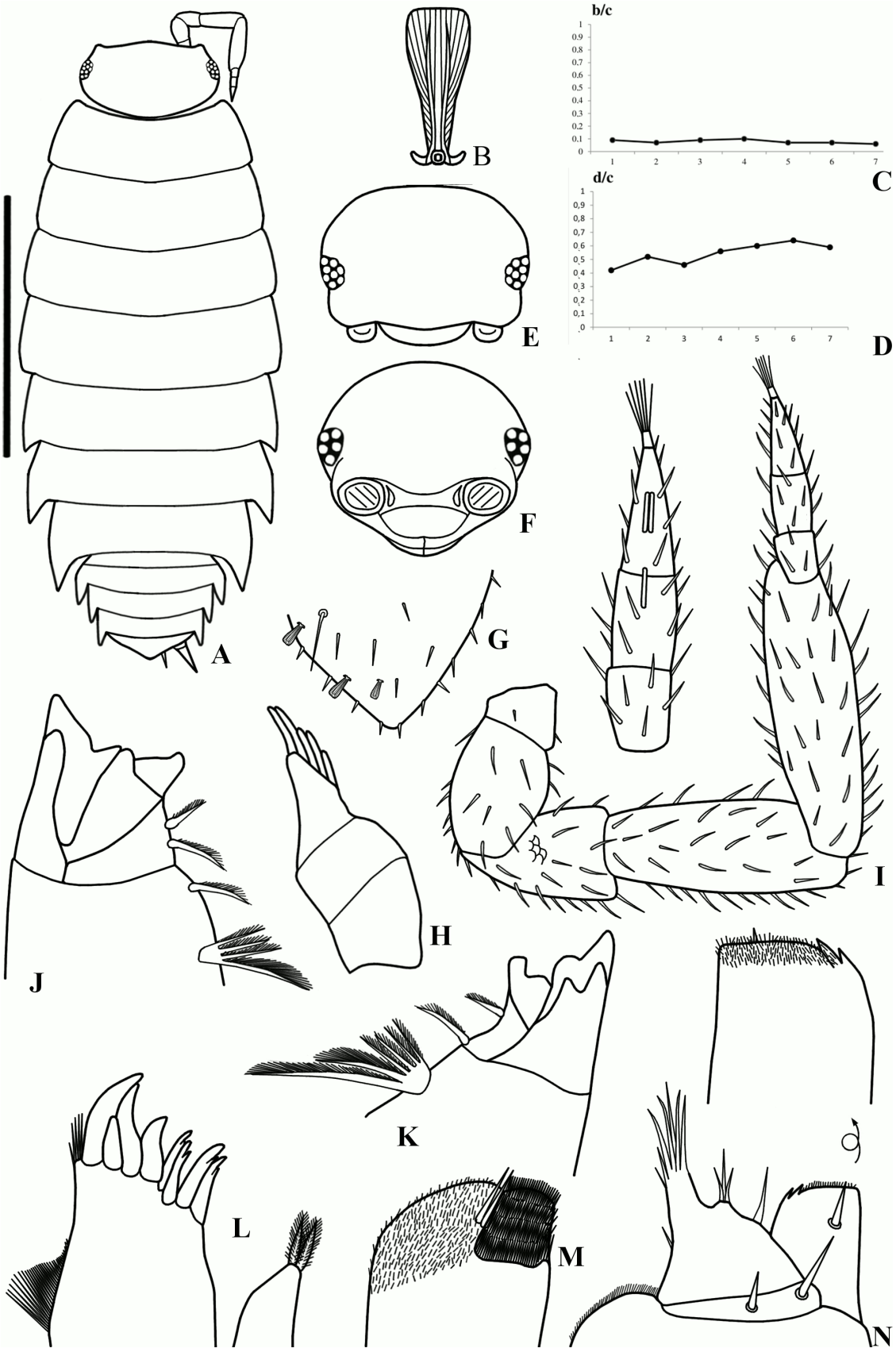


Figure 17. *Novamundoniscus* sp. 3, male, paratype UFRGS 6481. A, *habitus*; B, fan-shapedscale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, dorsal view; F, cephalothorax, frontal view; G, epimeron 1; H, antennula; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

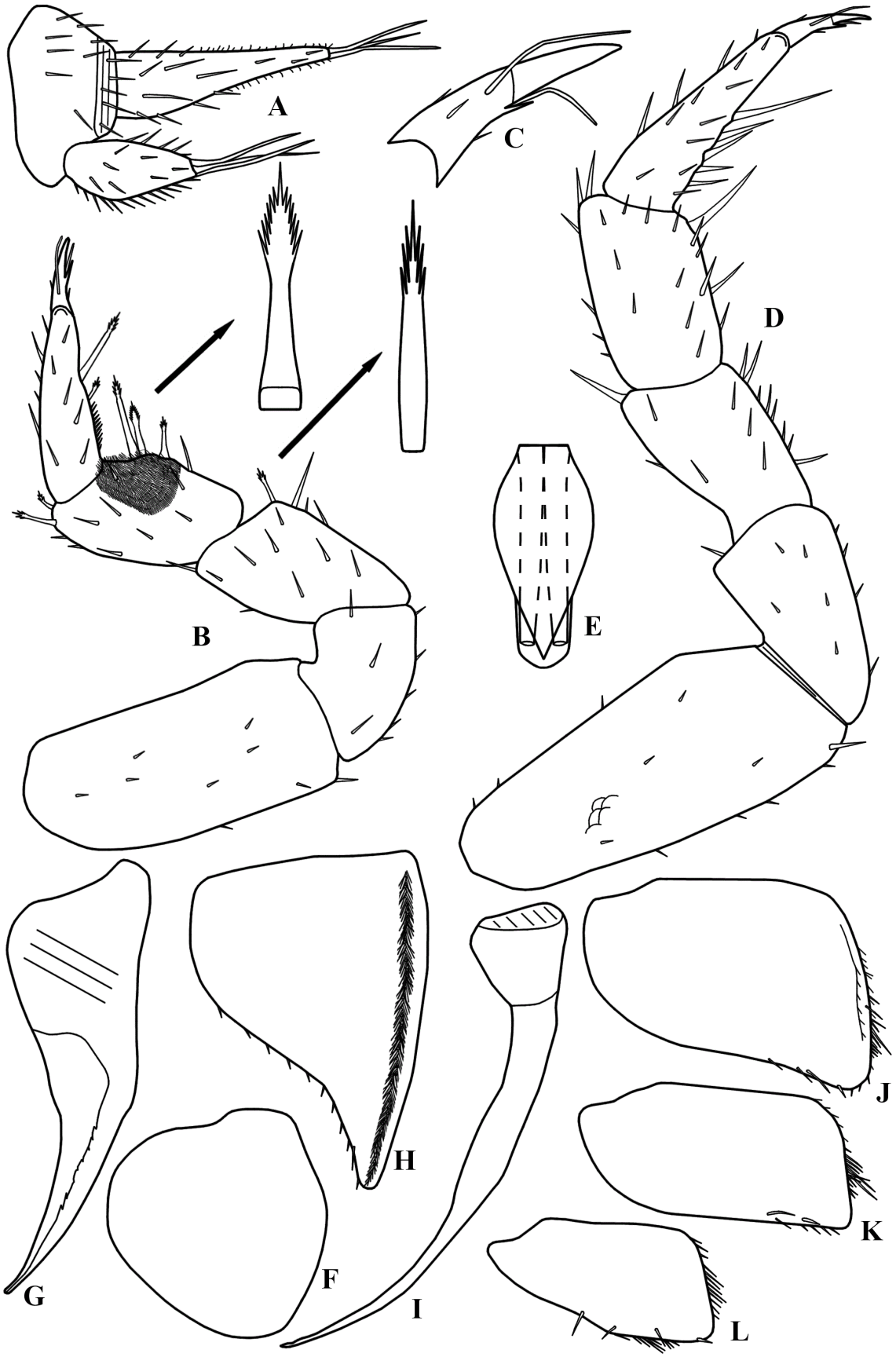


Figure 18. *Novamundoniscus* sp. 3, male, paratype UFRGS 6481. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

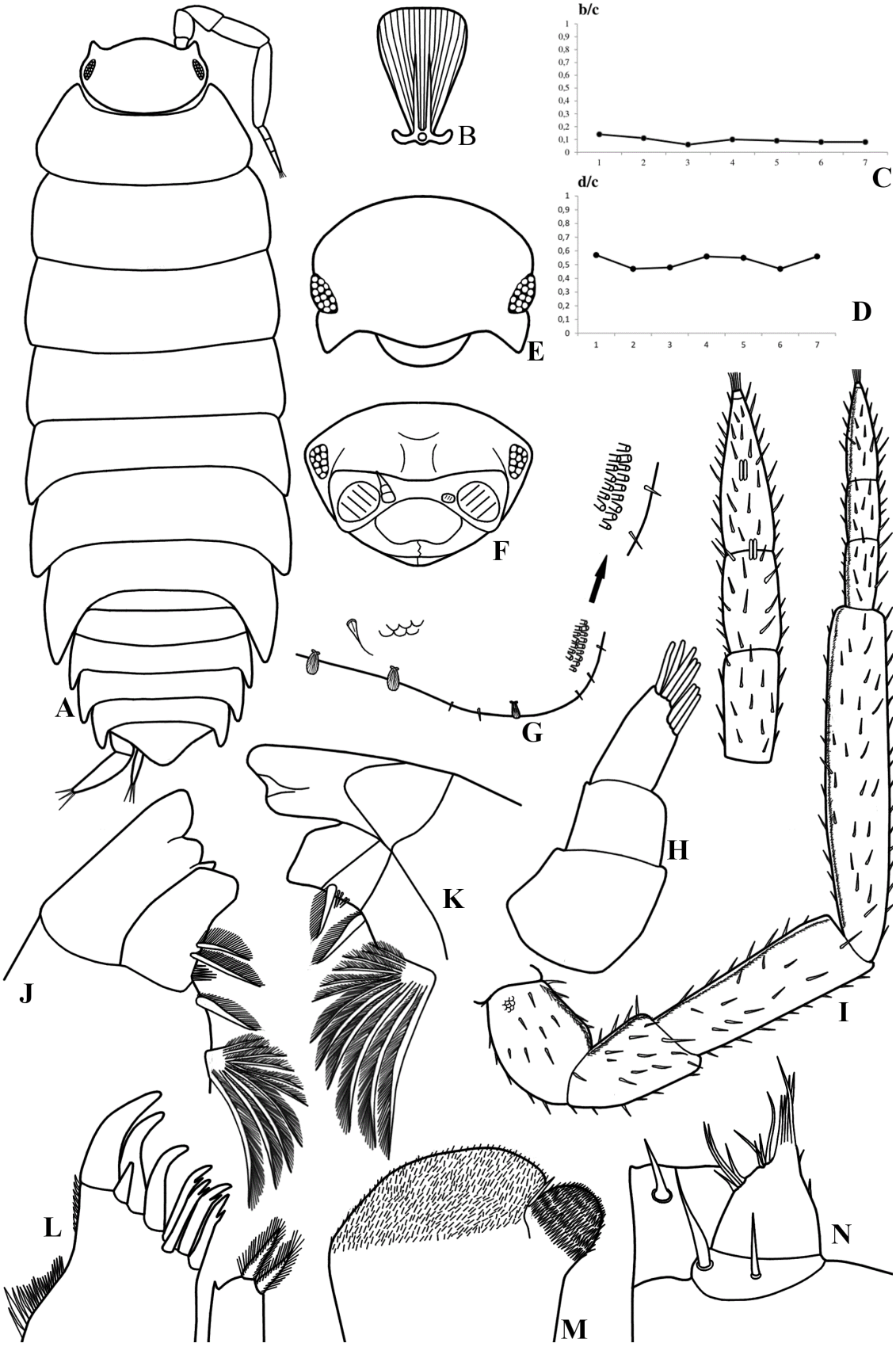


Figure 19. *Novamundoniscus* sp. 4, male UFRGS 6407. A, *habitus*; B, scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 1; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped.

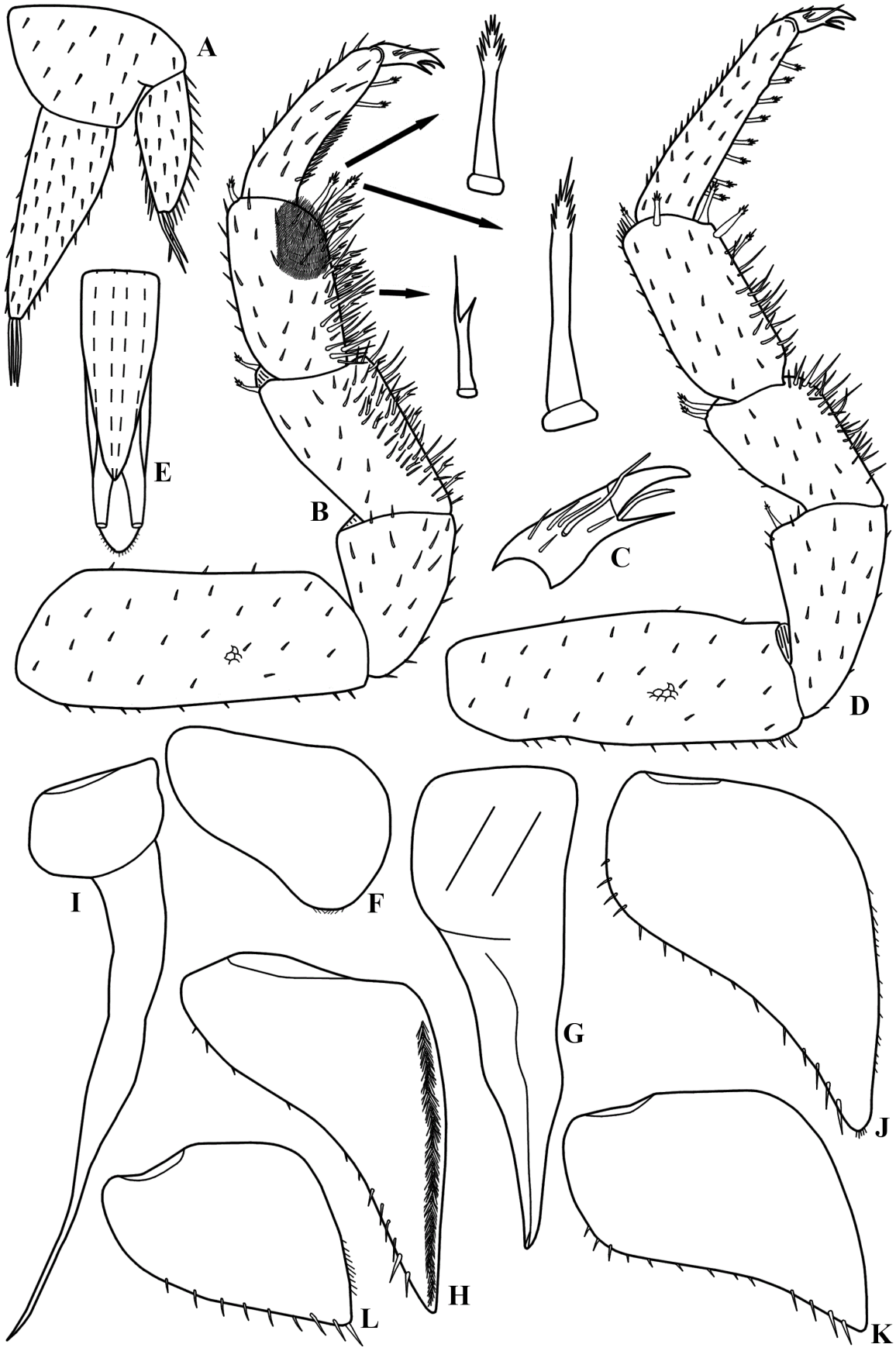


Figure 20. *Novamundoniscus* sp. 4, male UFRGS 6407. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

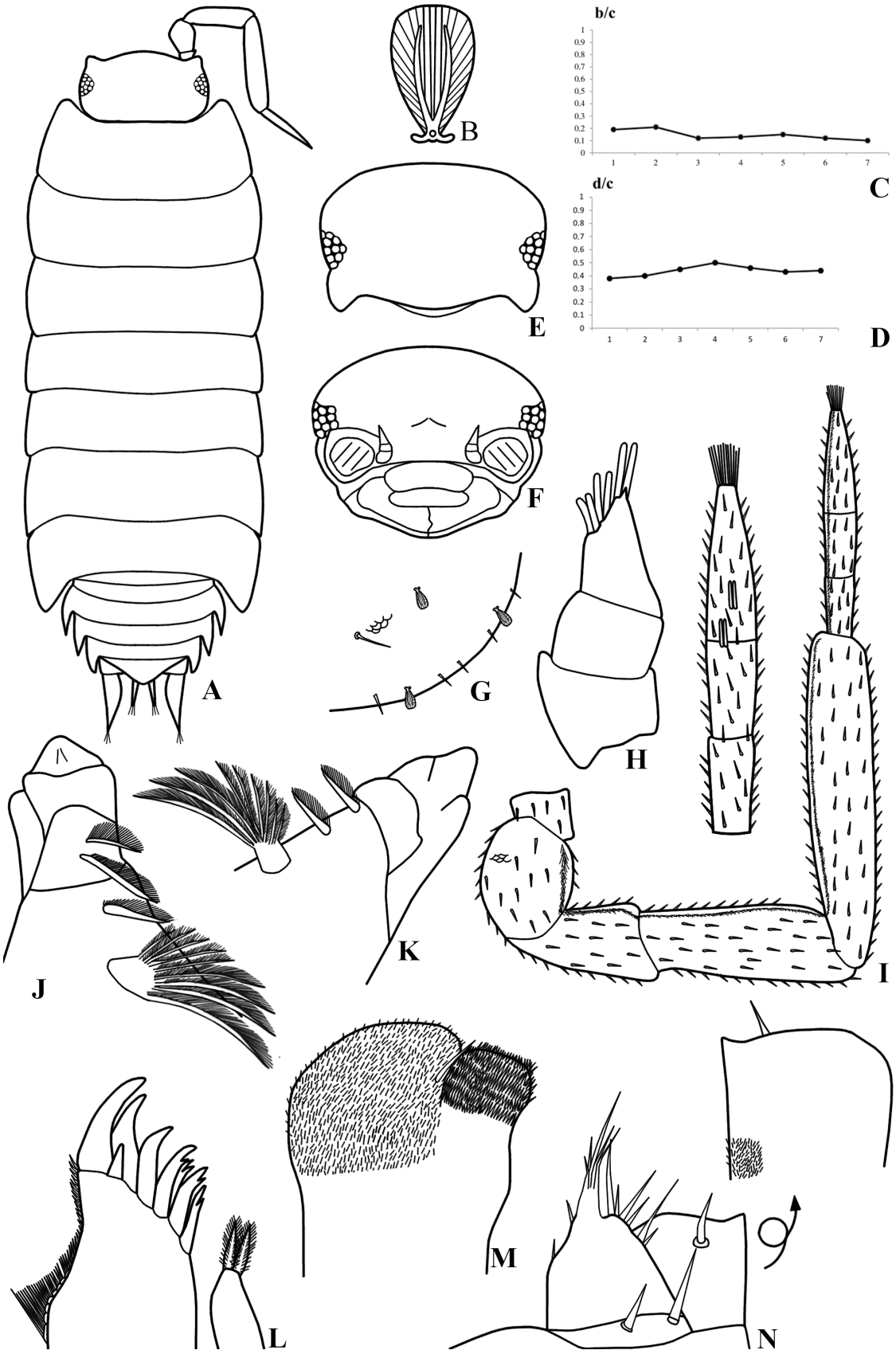


Figure 21. *Novamundoniscus* sp. 5, male paratype NMMN267280. A, *habitus*; B, scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 1; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped.

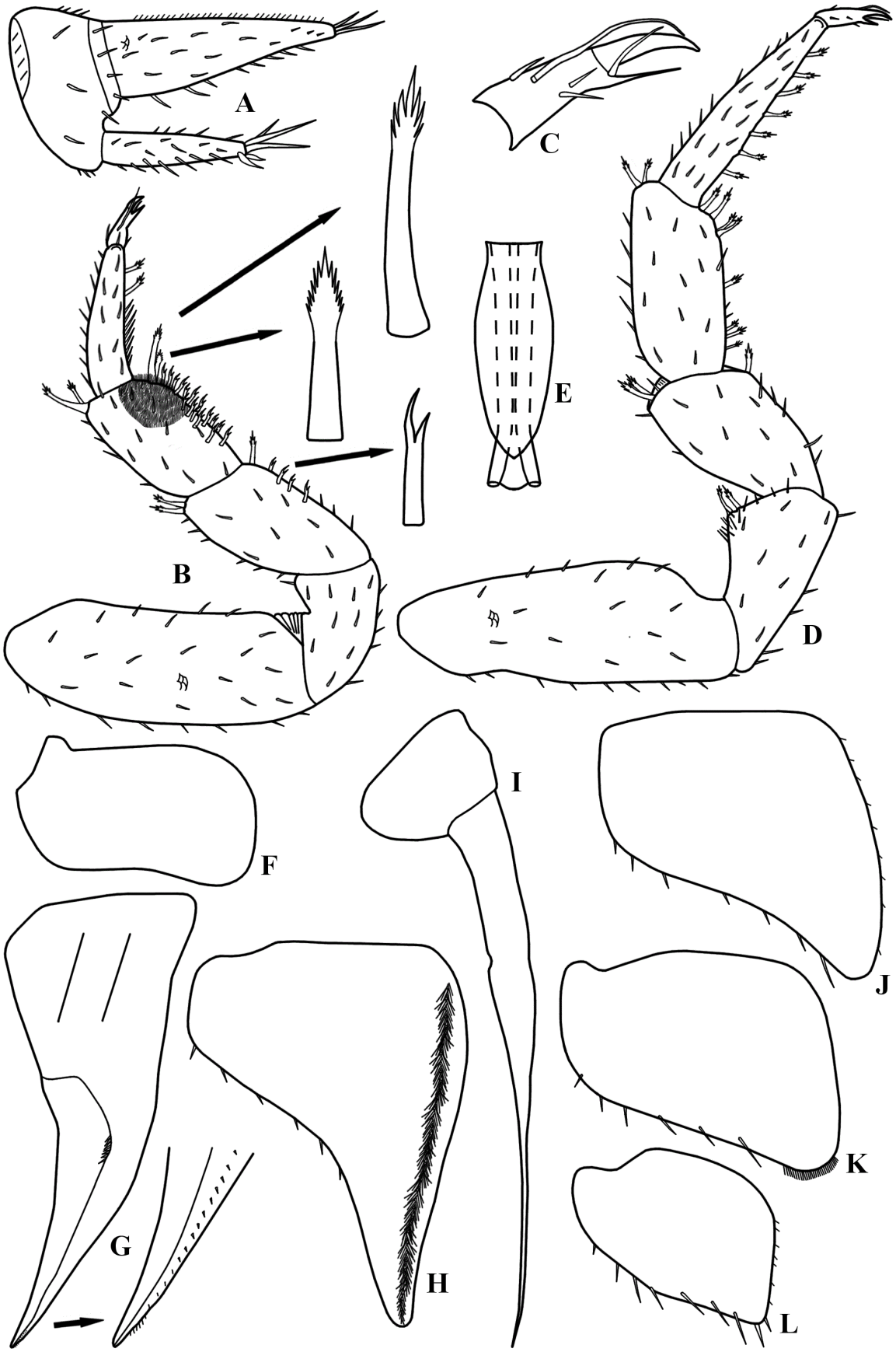


Figure 22. *Novamundoniscus* sp. 5, male paratype NMMN267280.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

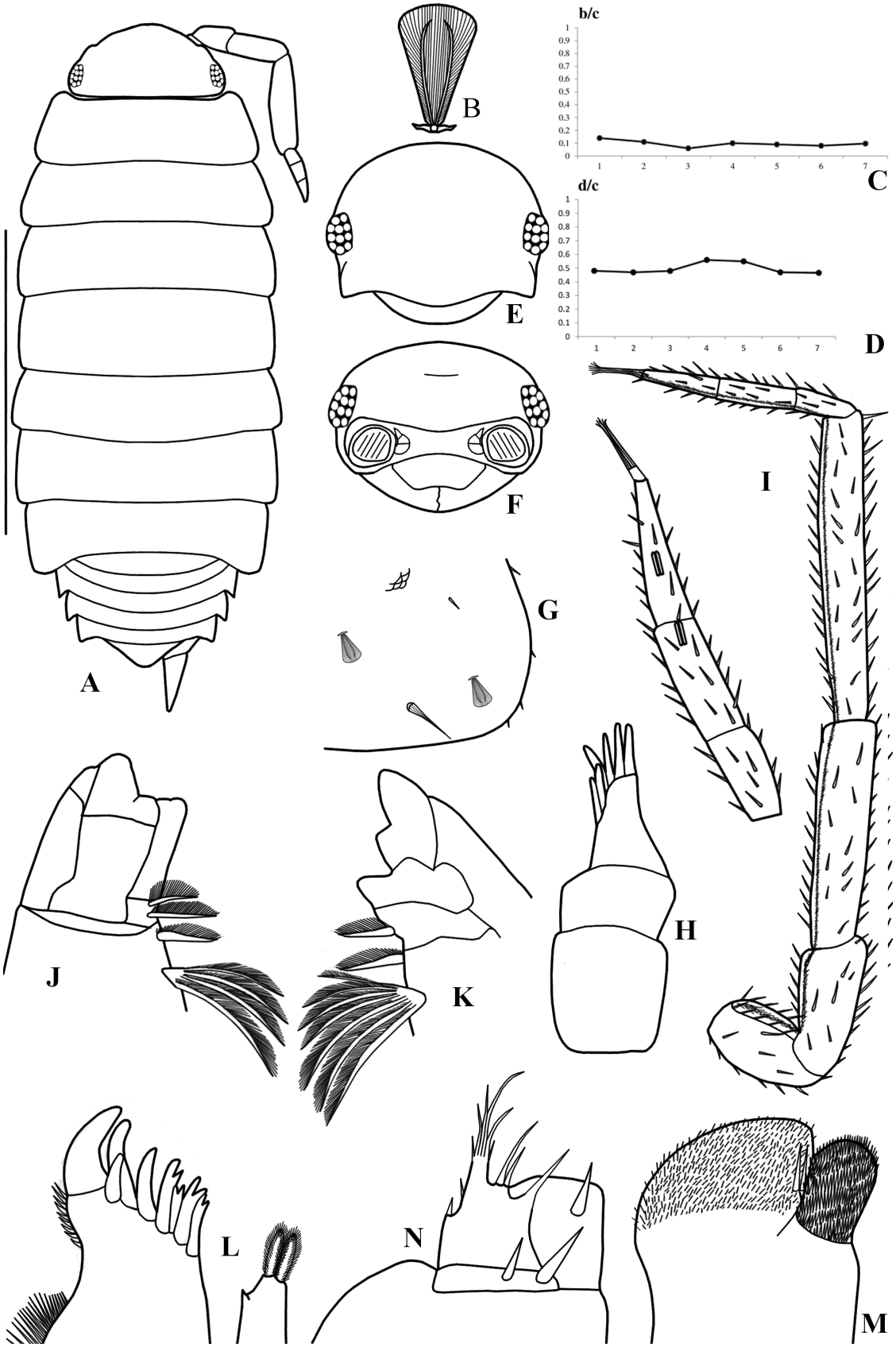


Figure 23. *Novamundoniscus* sp. 6, male paratype UFRGS 6996.A, *habitus*; B, scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 1; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped.

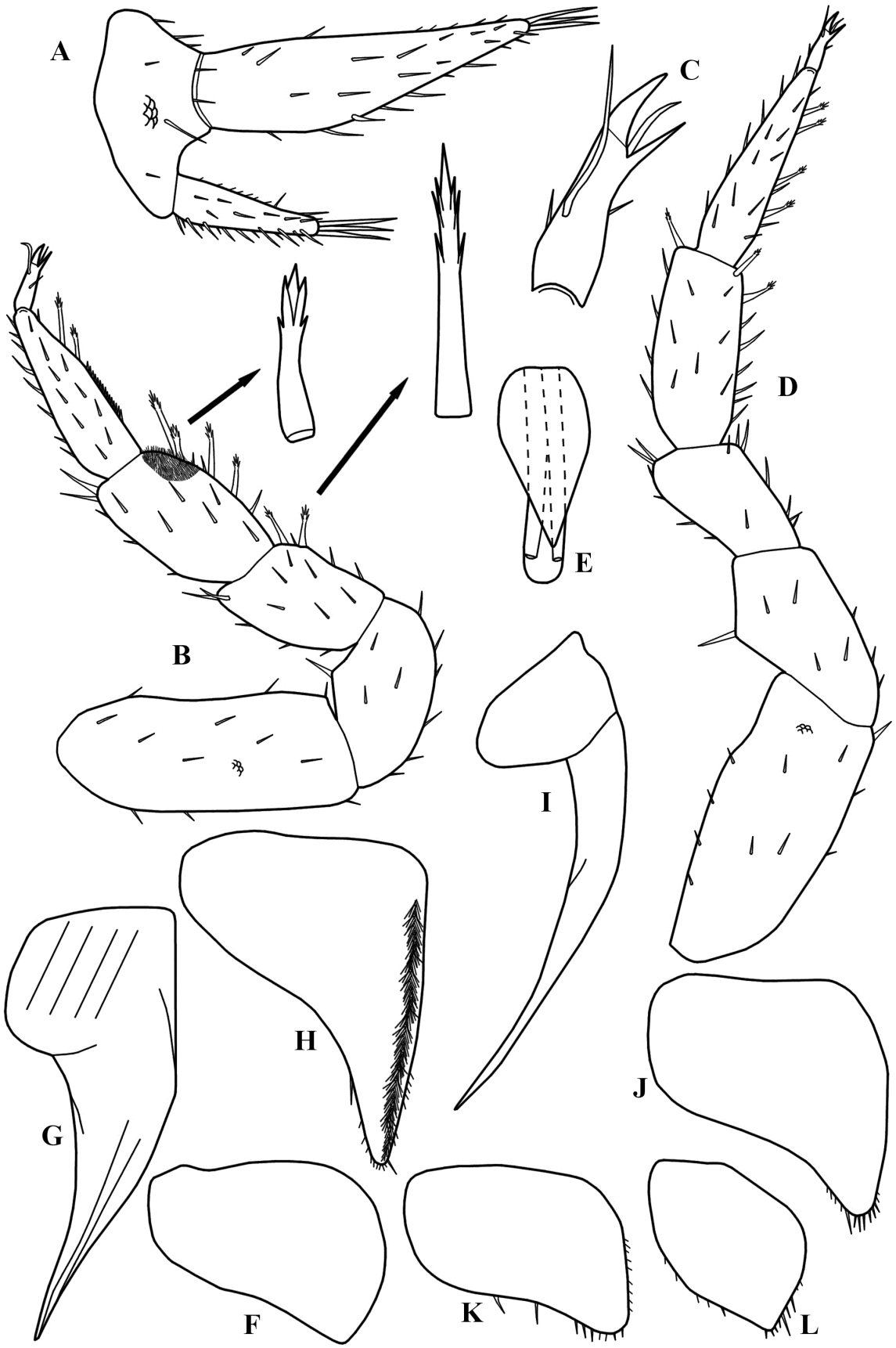


Figure 24. *Novamundoniscus* sp. 6, male paratype UFRGS 6996.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

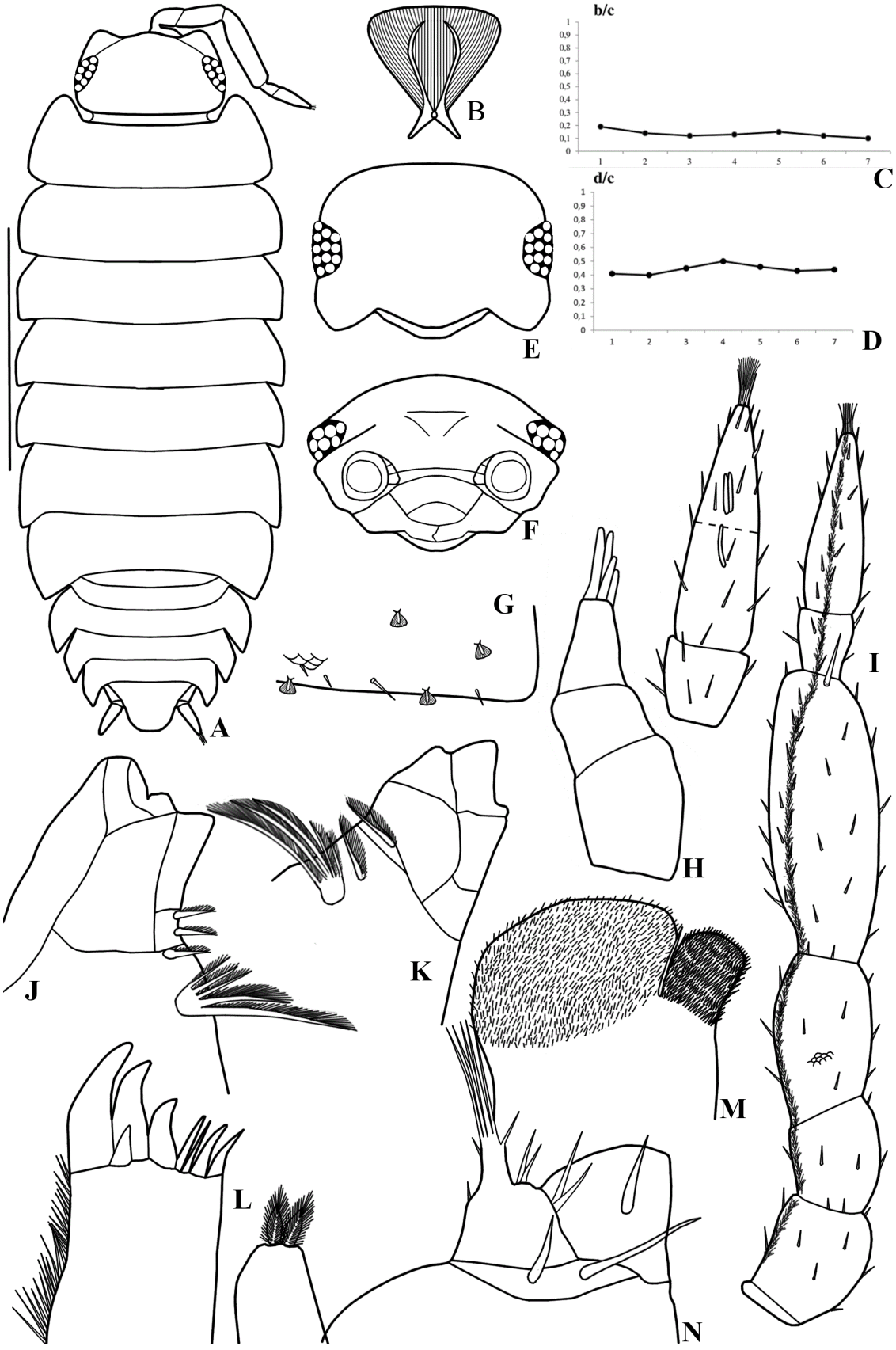


Figure 25. *Calycuoniscus goeldii* MNRJ 6205. A, *habitus*; B, scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 1; H, antennule; I, antenna; J left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped.

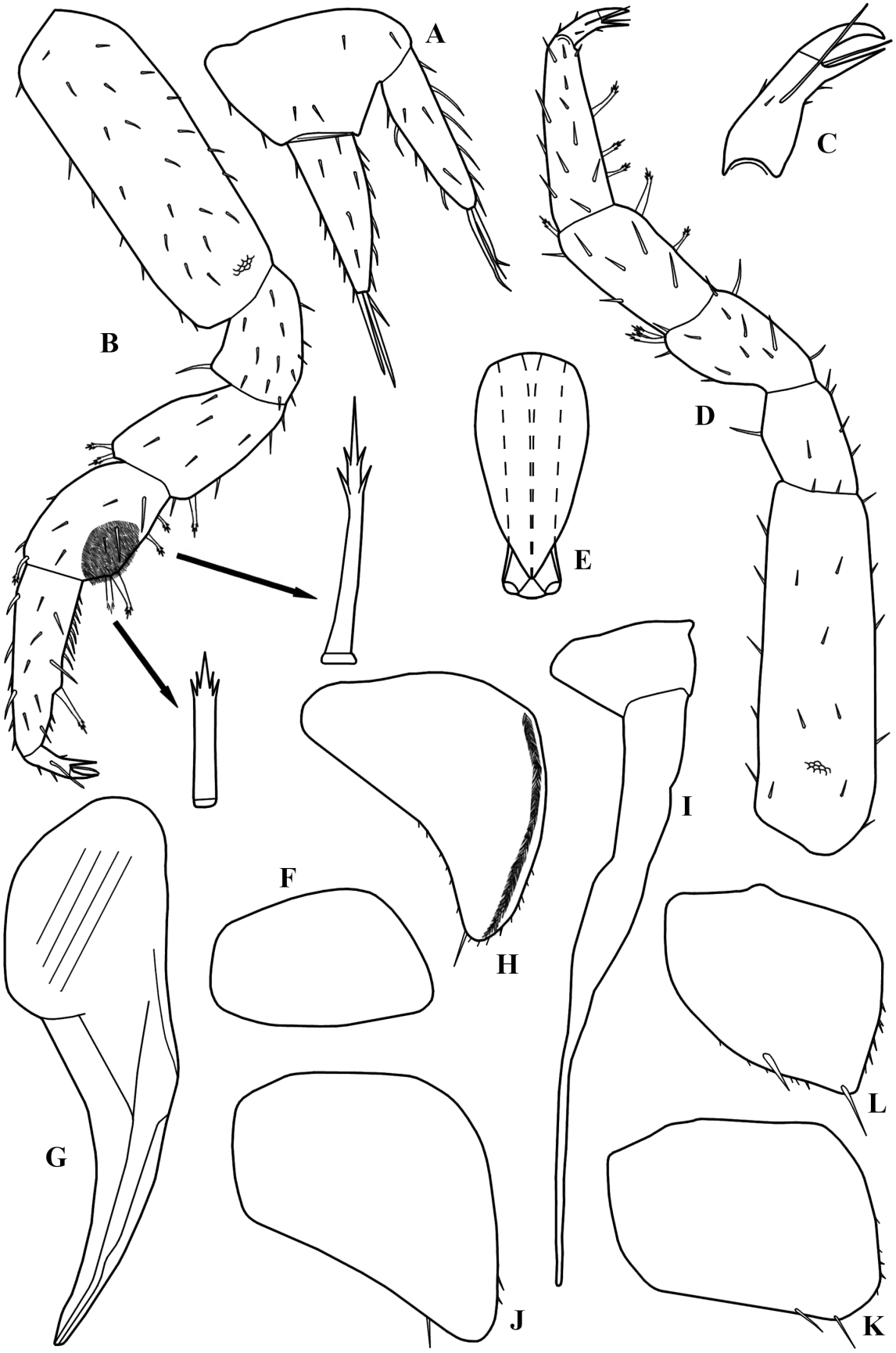


Figure 26. *Calycuoniscus goeldii* MNRJ 6205.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papila; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.

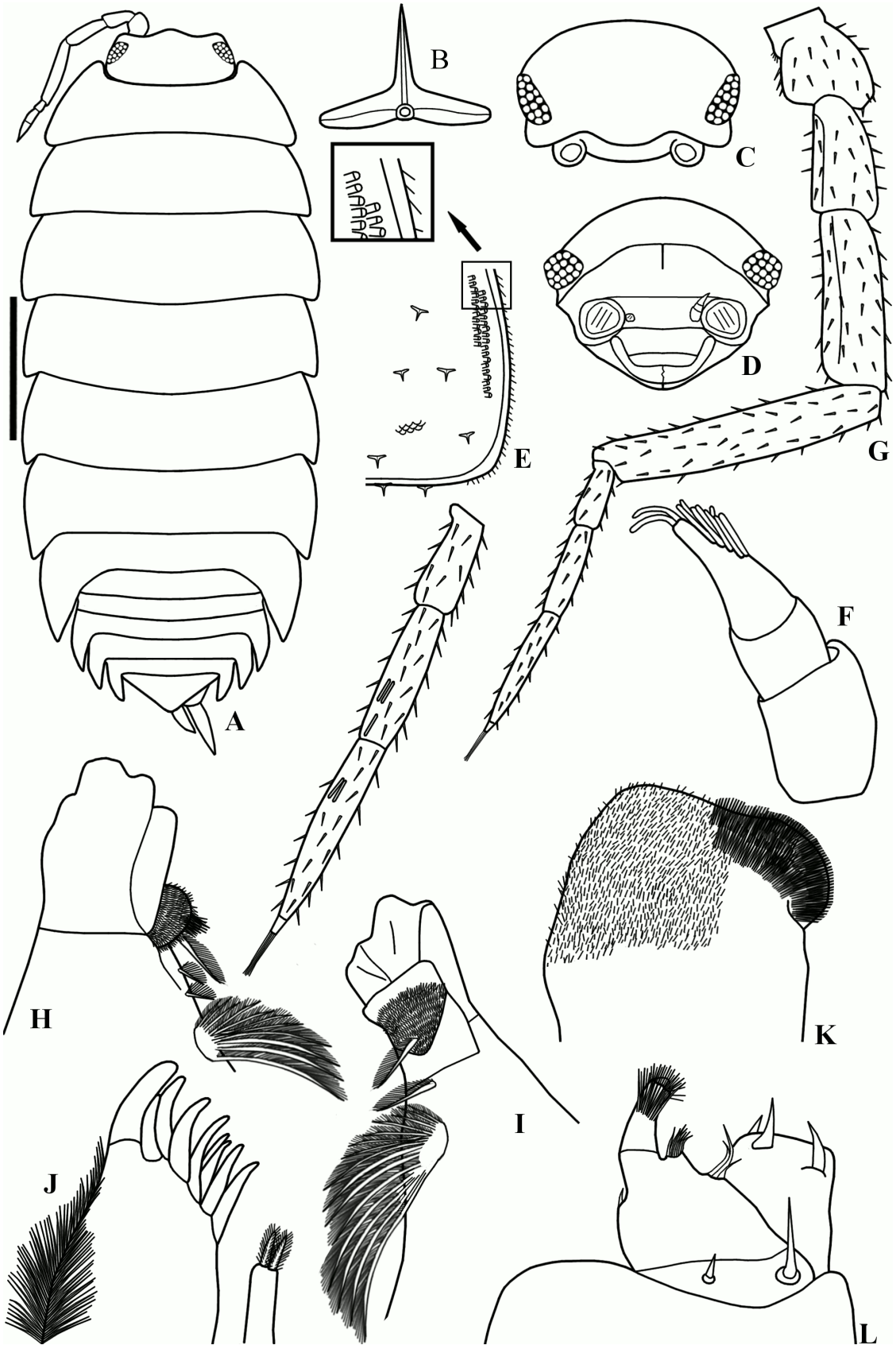


Figure 27. *Phalloniscus punctatus* (Thompson, 1879), male, additional material examined NMNH 18936. A, *habitus*; B, fan-shaped scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron 6; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

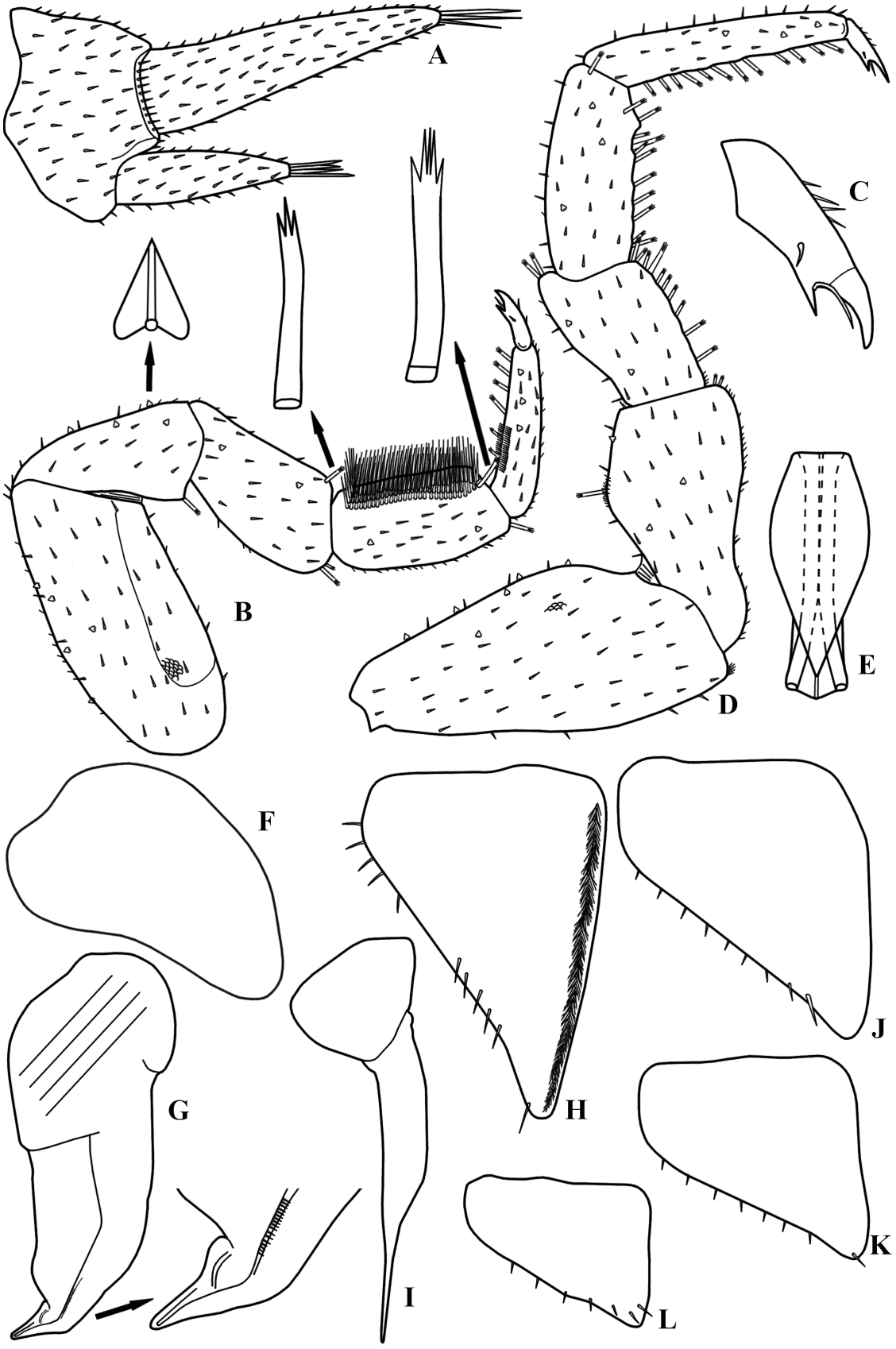


Figure 28. *Phalloniscus punctatus* (Thompson, 1879), male, additional material examined NMNH 18936. A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

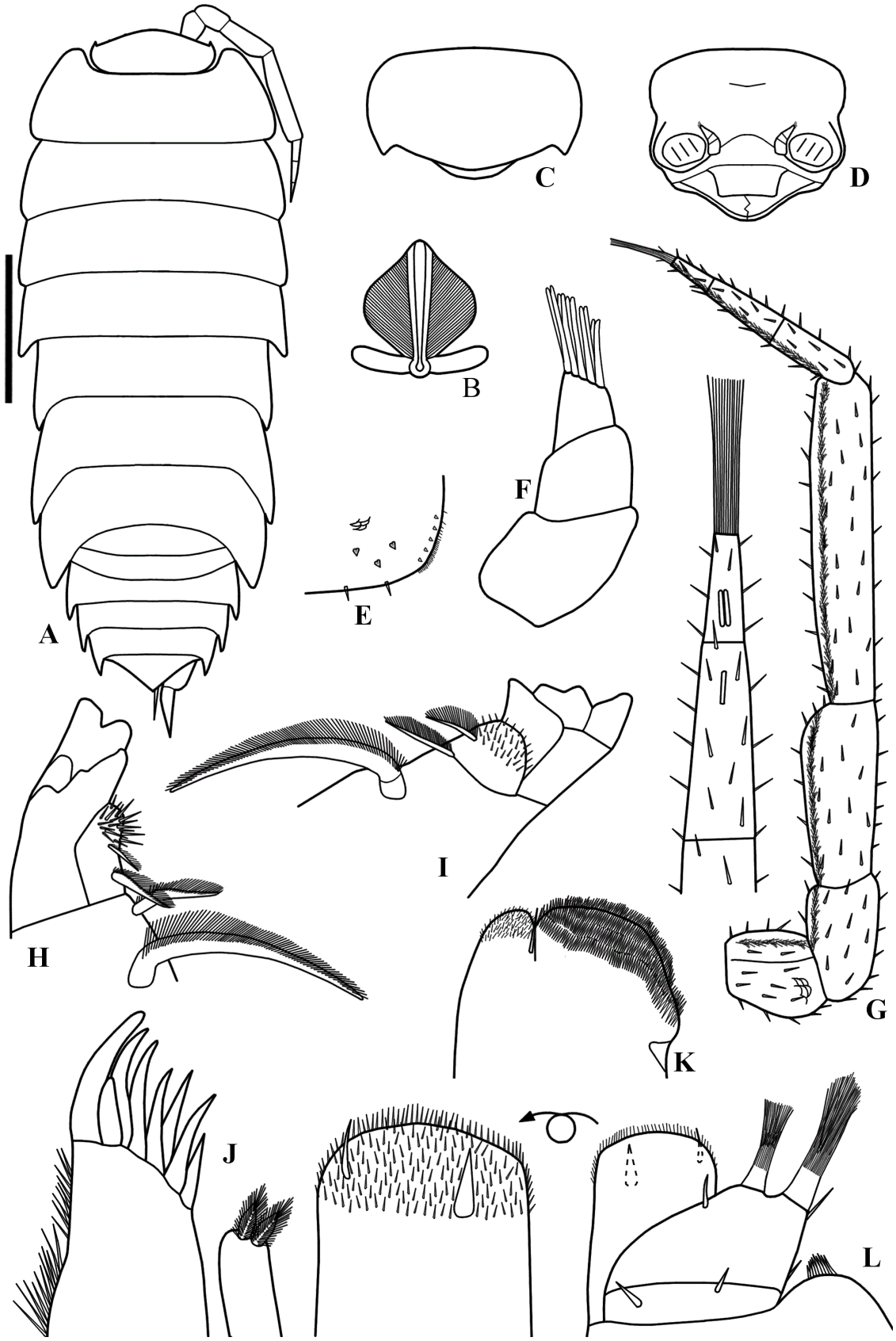


Figure 29. *Phalloniscus langi* (Van Name, 1936), male, paratype AMNH6570. A, *habitus*; B, trichorn scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron 3; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

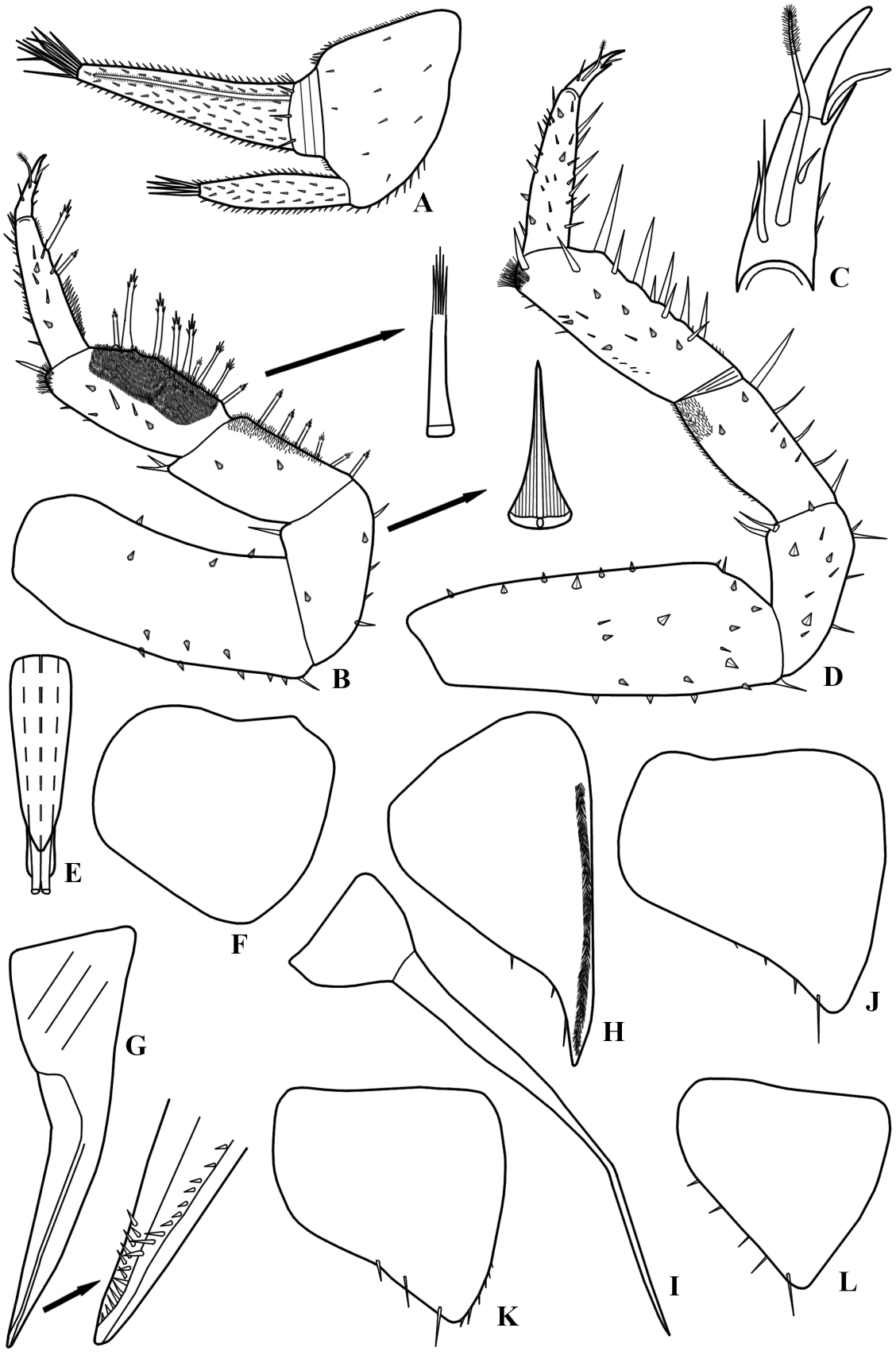


Figure 30. *Phalloniscus langi* (Van Name, 1936), male, paratypeAMNH6570.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

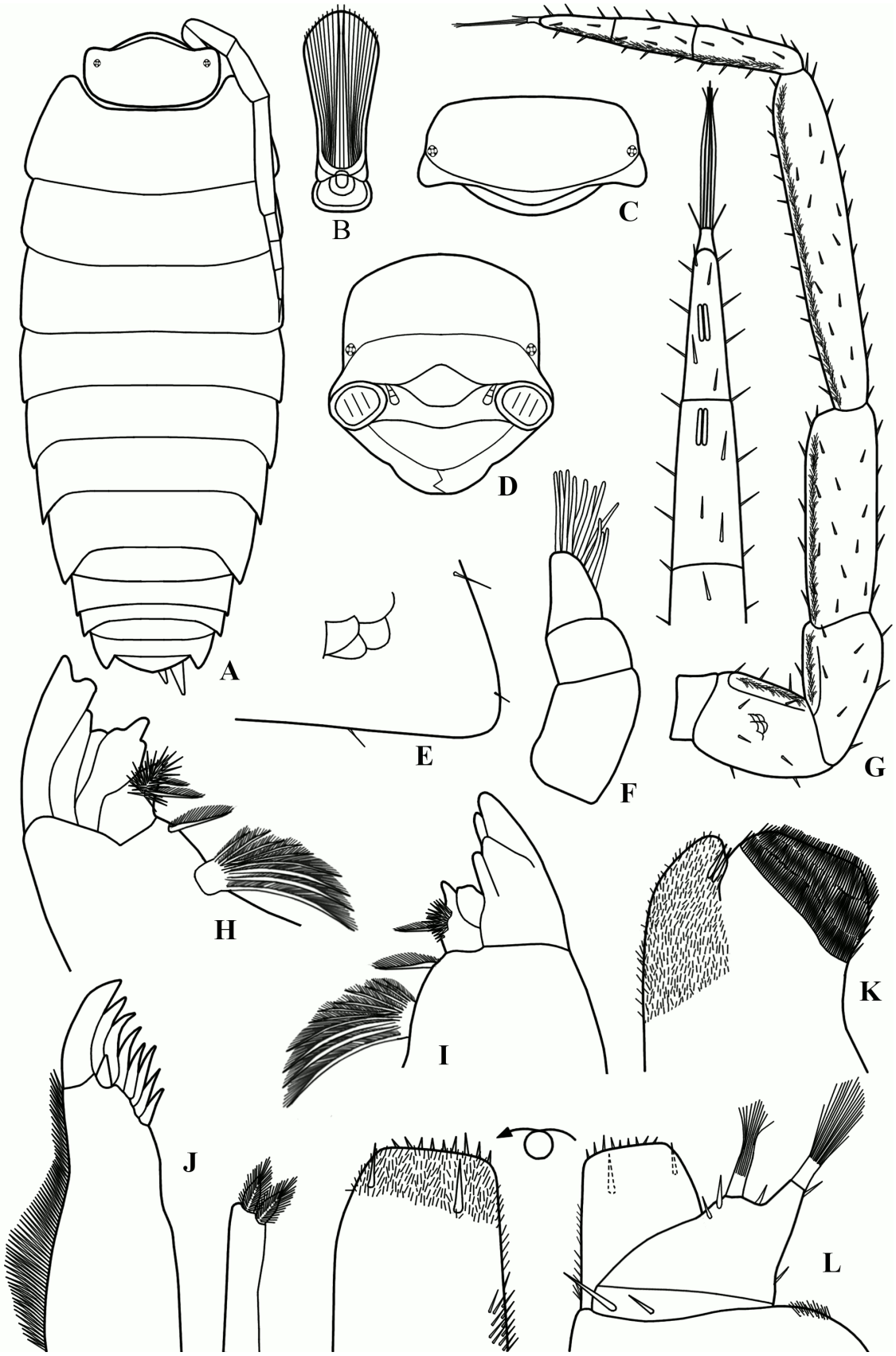


Figure 31. *Phalloniscus pearsei* (Van Name, 1936), male, paratype NMNH236474.A, *habitus*; B, trichorn scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron 3; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

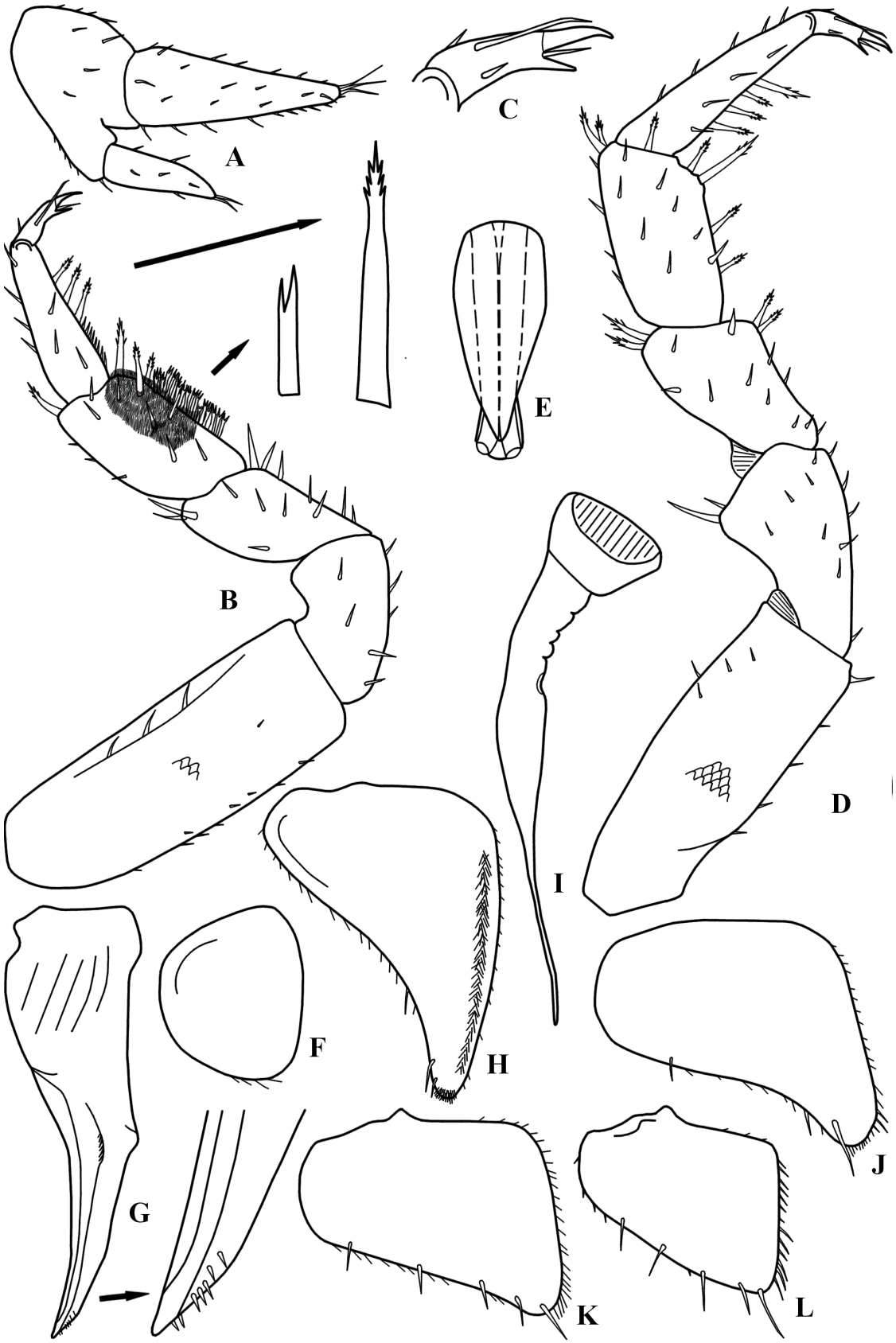


Figure 32. *Phalloniscus pearsei* (Van Name, 1936), male, paratype NMNH236474.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

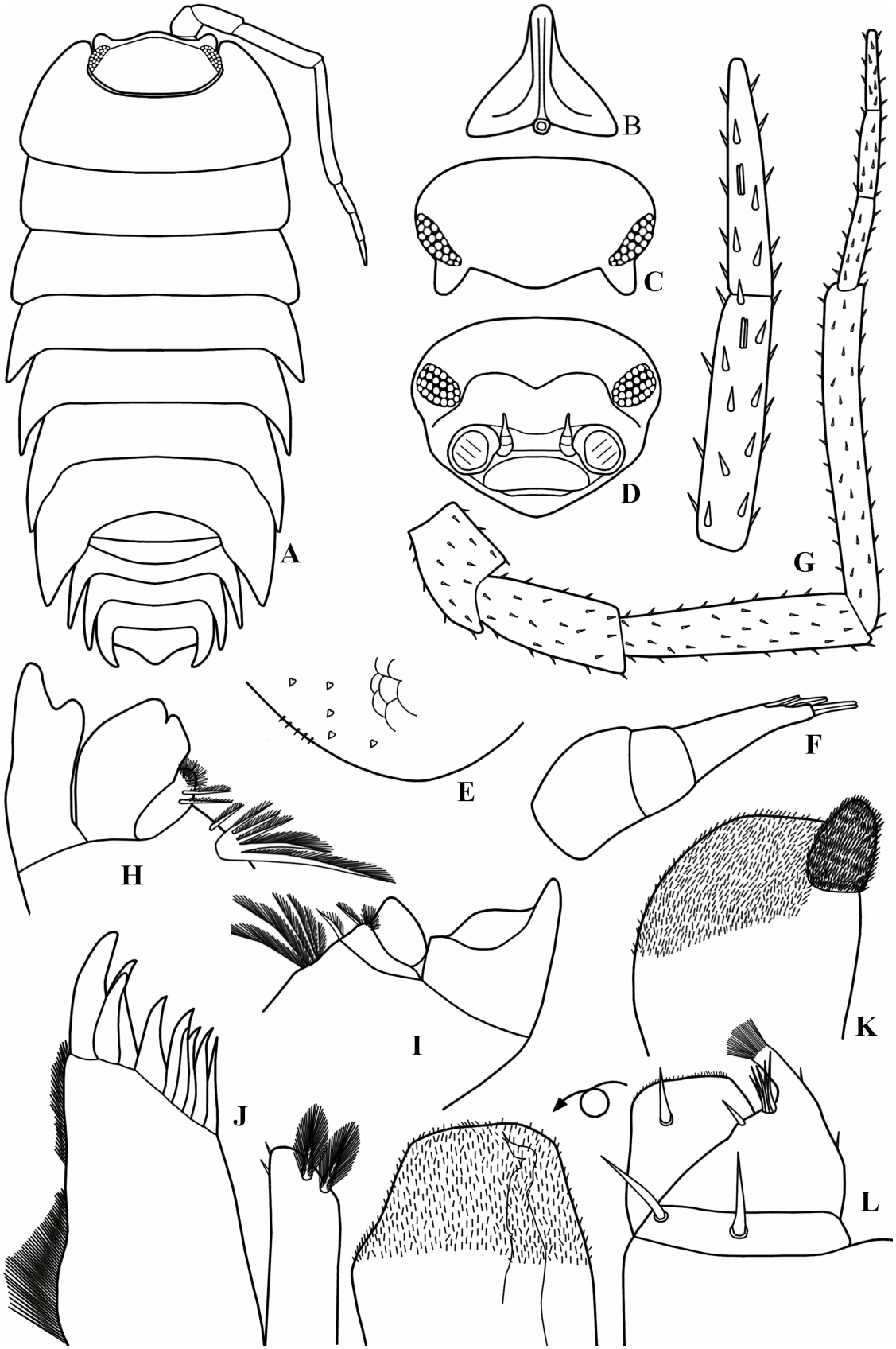


Figure 33. *Phalloniscus avrilensis* (Van Name, 1940), male, paratype NMNH236474.A, *habitus*; B, trichorn scale seta; C, cephalothorax, frontal view; D, cephalothorax, dorsal view; E, epimeron3; F, antennule; G, antenna; H left mandible; I, right mandible; J, maxillule; K, maxilla; L, maxilliped. Scale bar: 1mm.

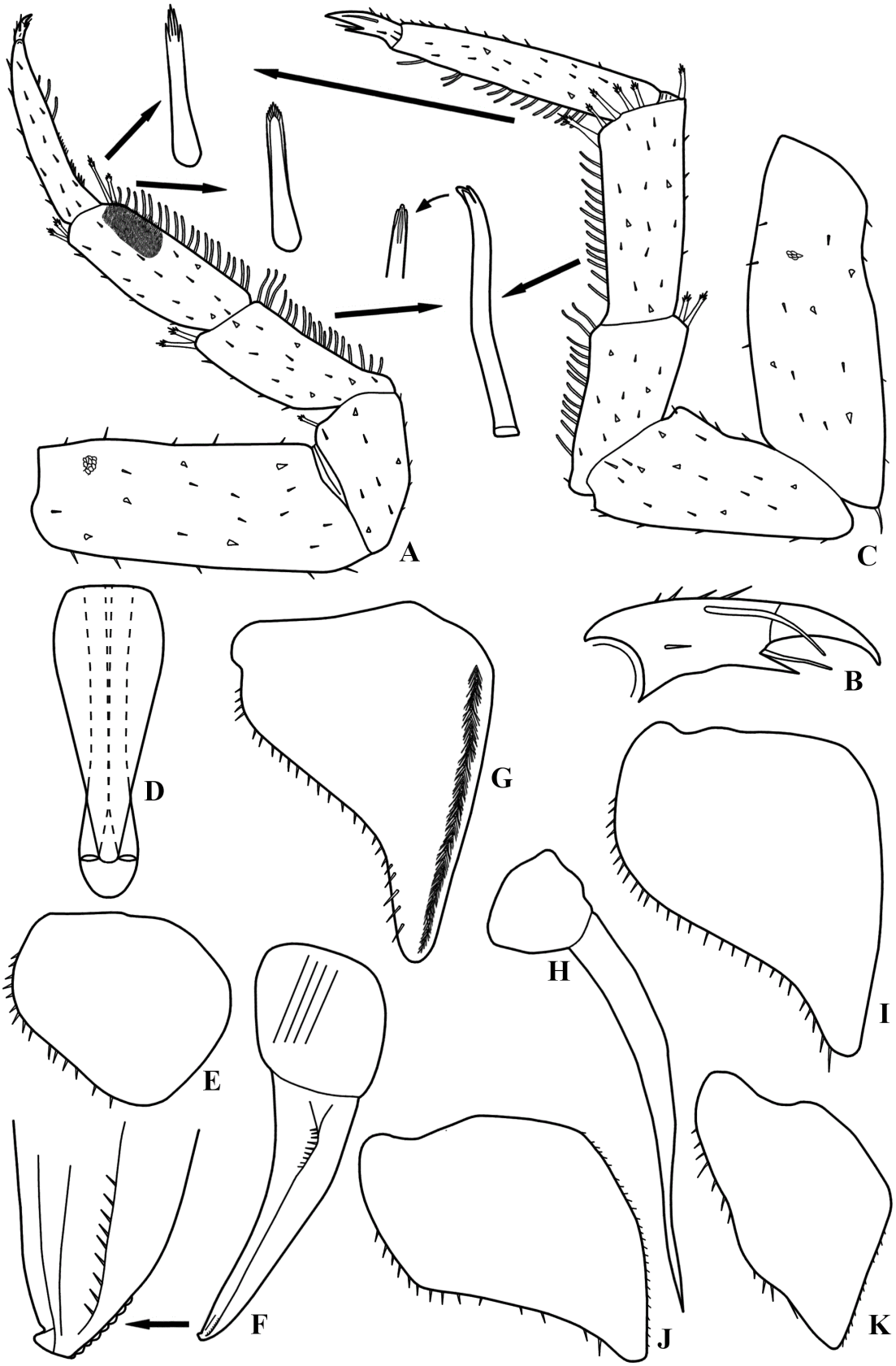


Figure 34. *Phalloniscus avrilensis* (Van Name, 1940), male, paratype NMNH236474.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J, pleopod 3 exopod; K, pleopod 4 exopod; L, pleopod 5 exopod.

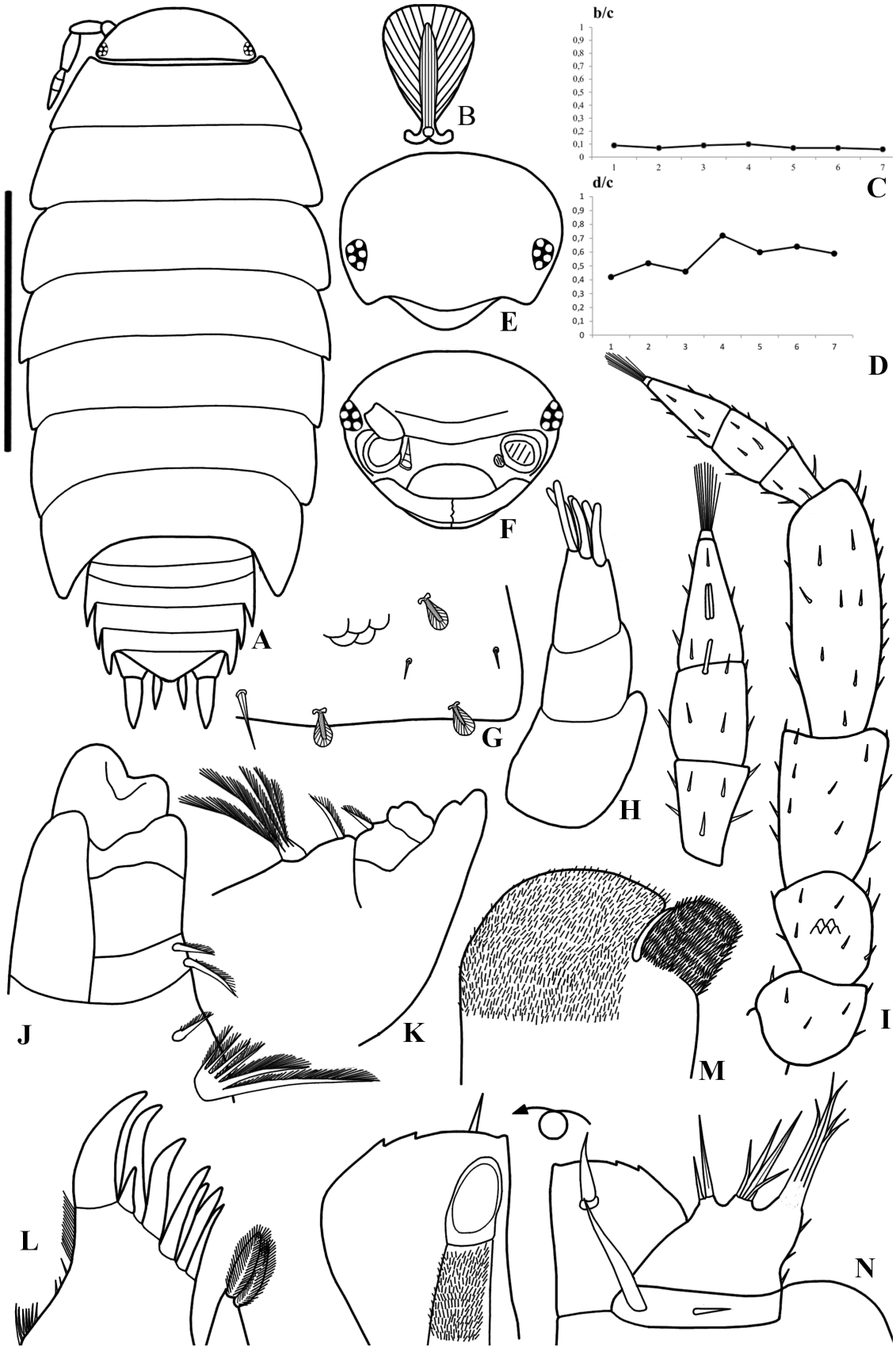


Figure 35. *Phalloniscus loyolai* Zardo, 1989, male, paratype MZUSP9705.A, *habitus*; B, fan-shaped scale seta; C, b/c *noduli laterales* coordinates; D, d/c *noduli laterales* coordinates; E, cephalothorax, frontal view; F, cephalothorax, dorsal view; G, epimeron 6; H, antennule; I, antenna; J, left mandible; K, right mandible; L, maxillule; M, maxilla; N, maxilliped. Scale bar: 1mm.

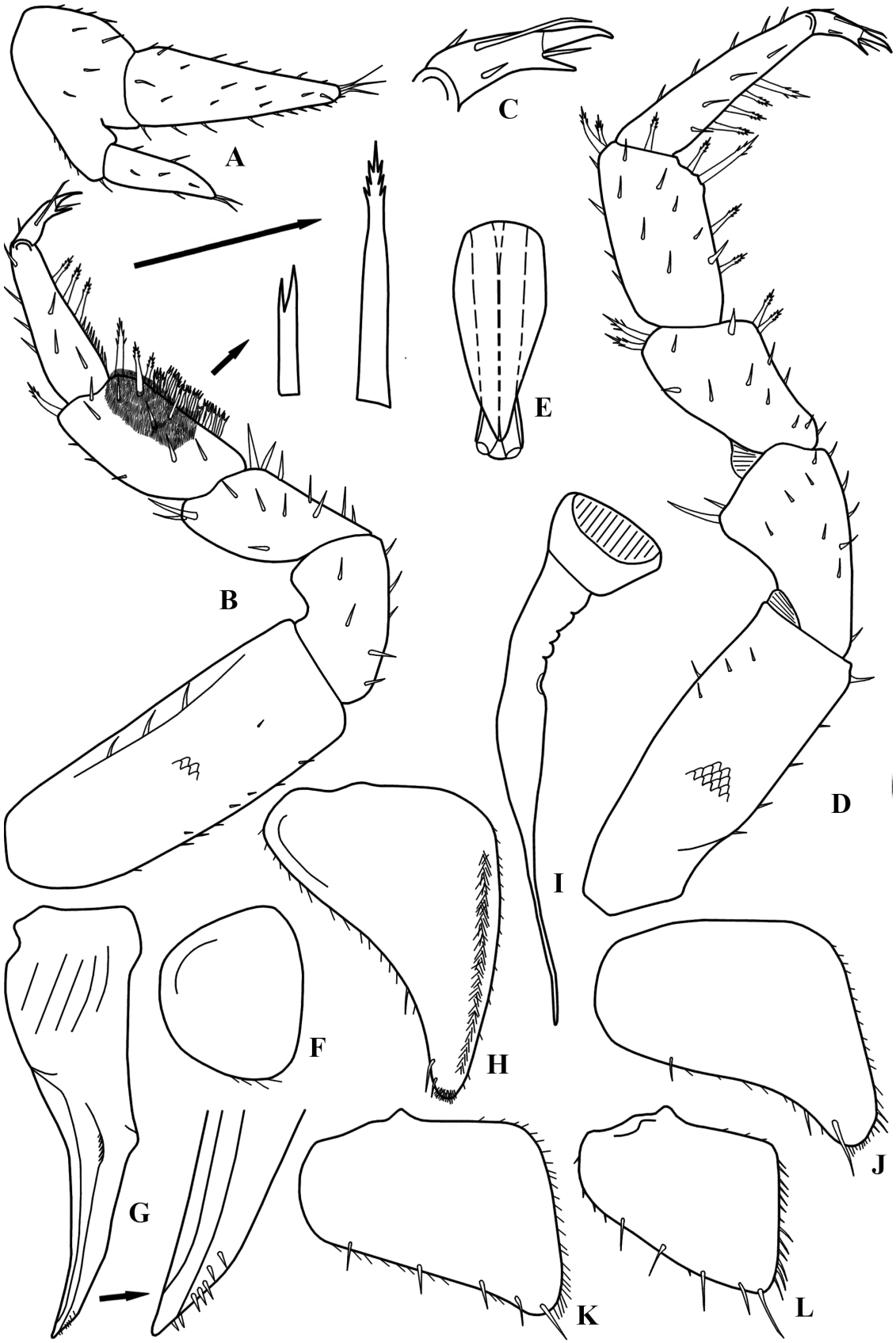


Figure 36. *Phalloniscus loyolai* Zardo, 1989, male, paratype MZUSP9705.A, uropod; B, pereopod 1; C, dactylus; D, pereopod 7; E, genital papilla; F, pleopod 1 exopod; G, pleopod 1 endopod; H, pleopod 2 exopod; I, pleopod 2 endopod; J pleopod 3 exopod; K pleopod 4 exopod; L pleopod 5 exopod.


Figure 37. Species of *Novamundoniscus* in dorsal view: A, *N. vandeli;* B, *N. dissimilis;* C, *N. macrophthalmus*; D, *N. setosus*.


Figure 38. Species of *Dubioniscus and Novamundoniscus* in dorsal view: A, *Dubioniscus gracilis*; B, *Novamundoniscus* sp. 1*;* C, *Novamundoniscus* sp. 2*;* D, *Novamundoniscus* sp. 3.


Figure 39. Species of *Novamundoniscus* and *Calyuconiscus* n dorsal view: A, *Novamundoniscus* sp. 4; B, *Novamundoniscus* sp. 5*;* C, *Novamundoniscus* sp. 6*;* D, *C. goeldii*.

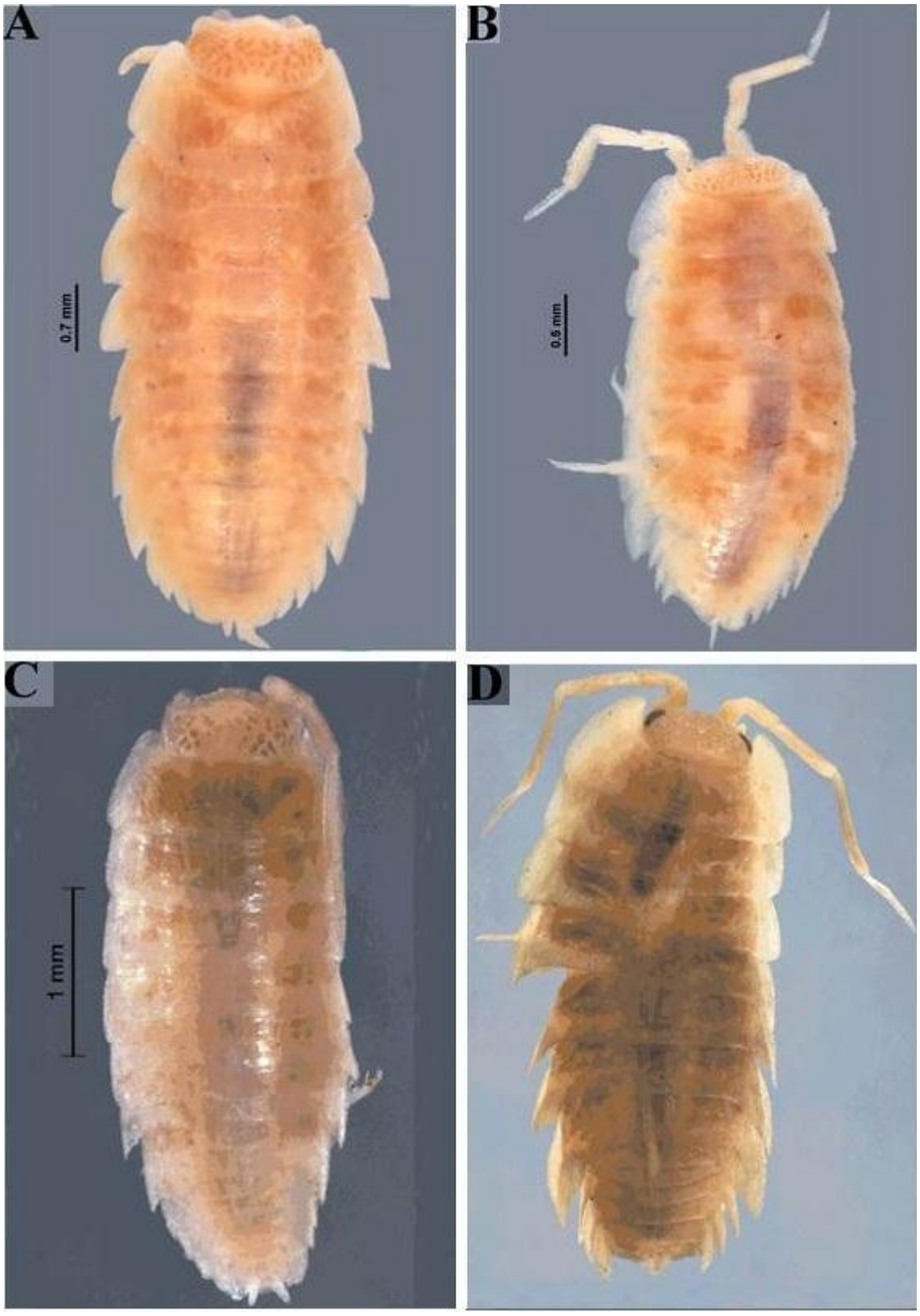


Figure 40. Species of *Phalloniscus* n dorsal view: A, *P. punctatus*. 4; B, *P. langi*. 5*;* C, *P. pearsei;* D, *P. avrilensis.*

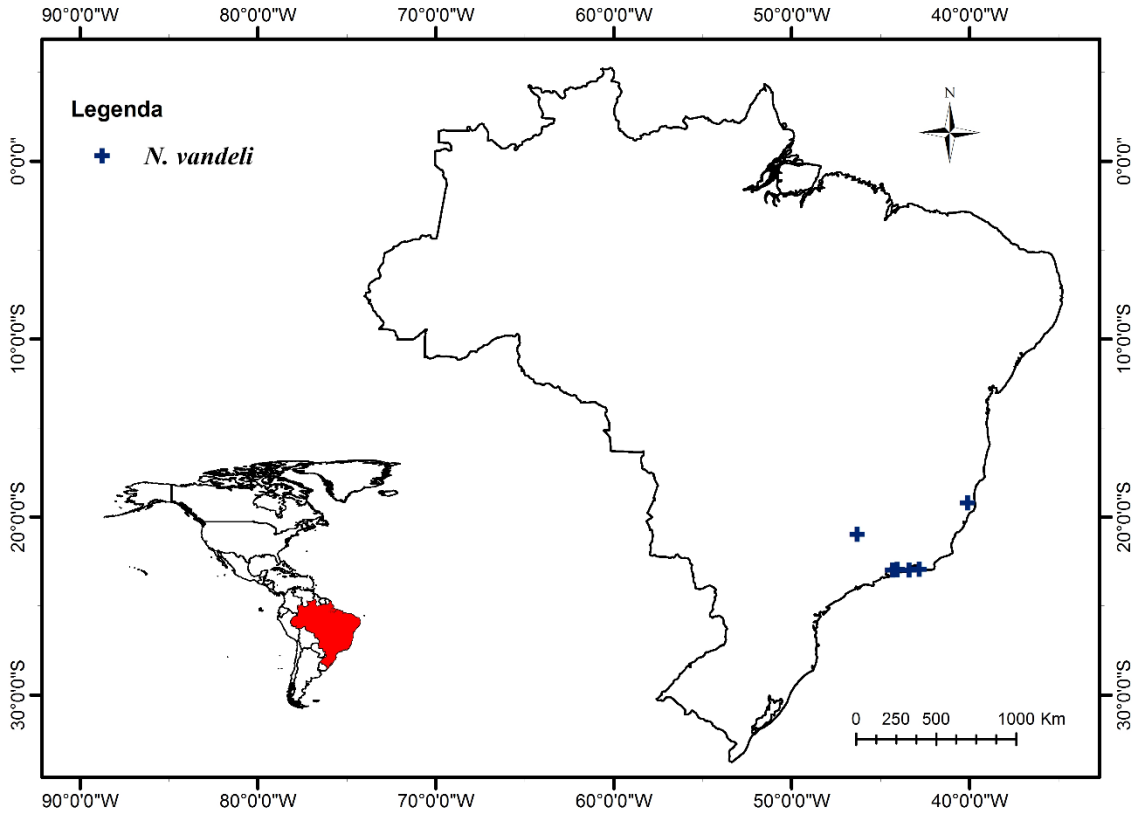


Figure 41. Distribution map of *N. vandeli*

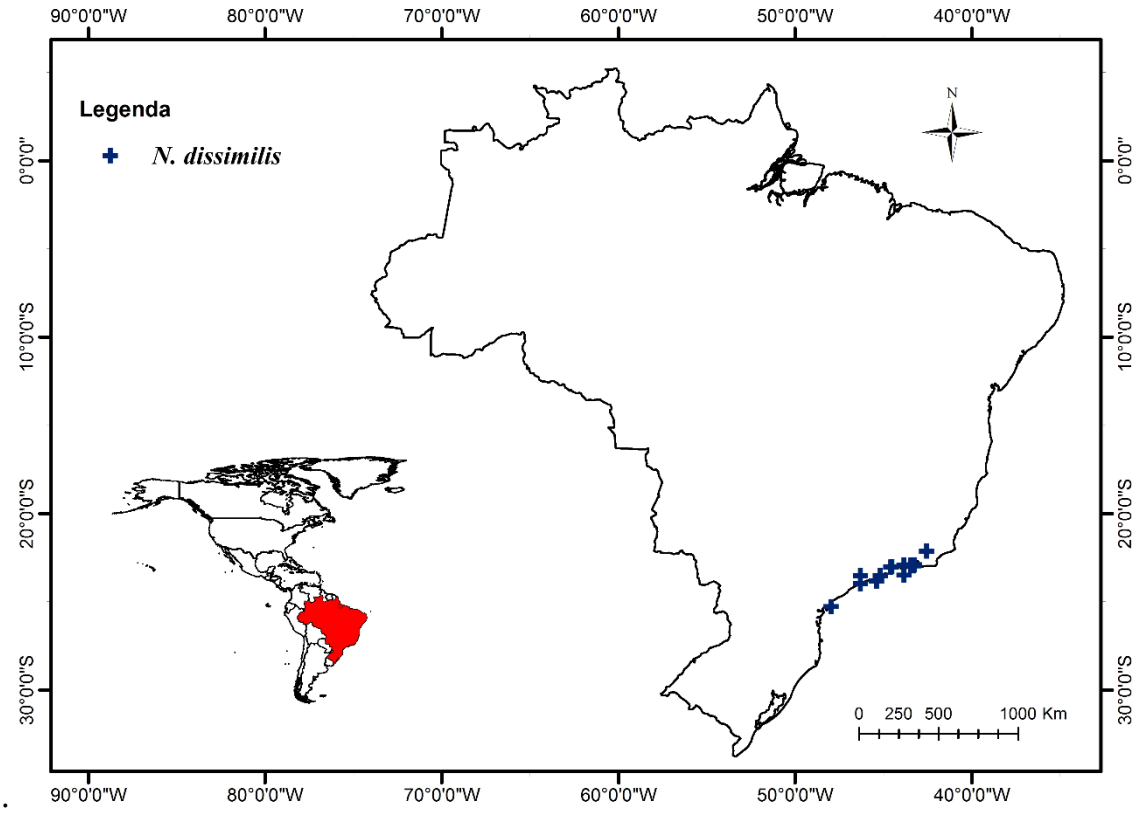


Figure 42. Distribution map of *N. dissimilis*.

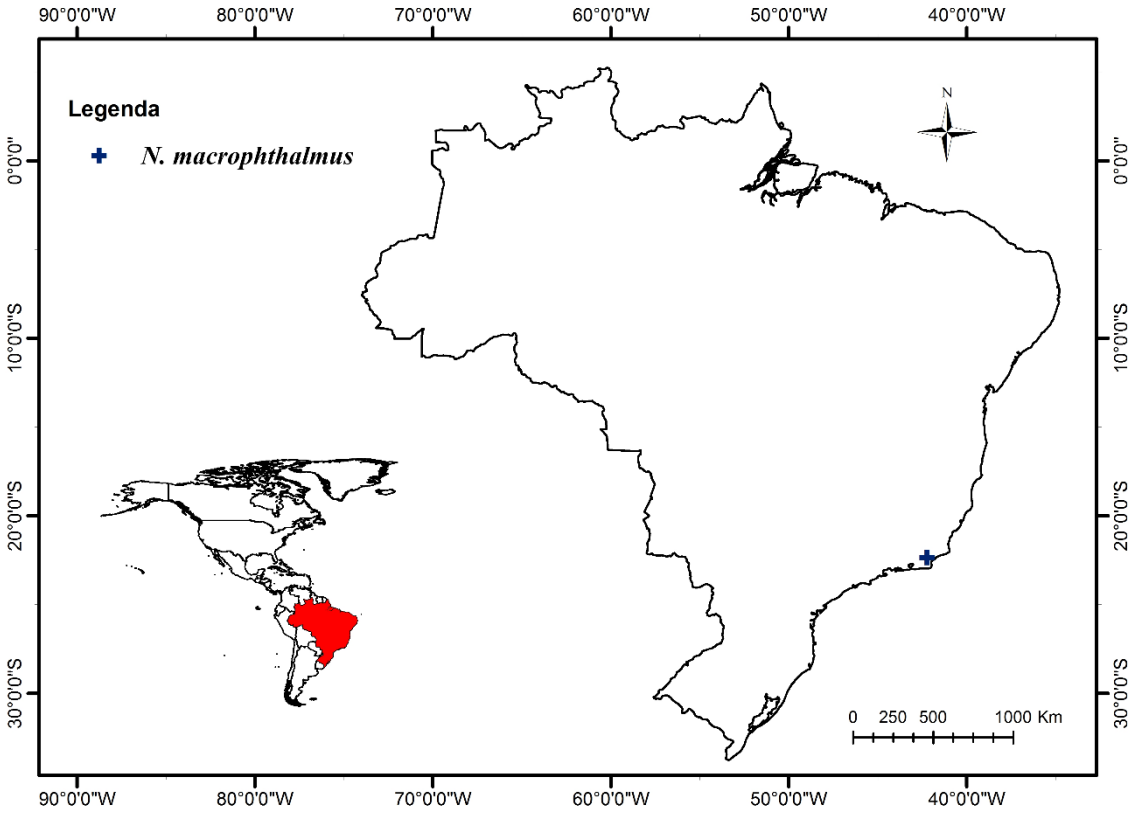


Figure 43. Distribution map of *N. macrophthalmus*.

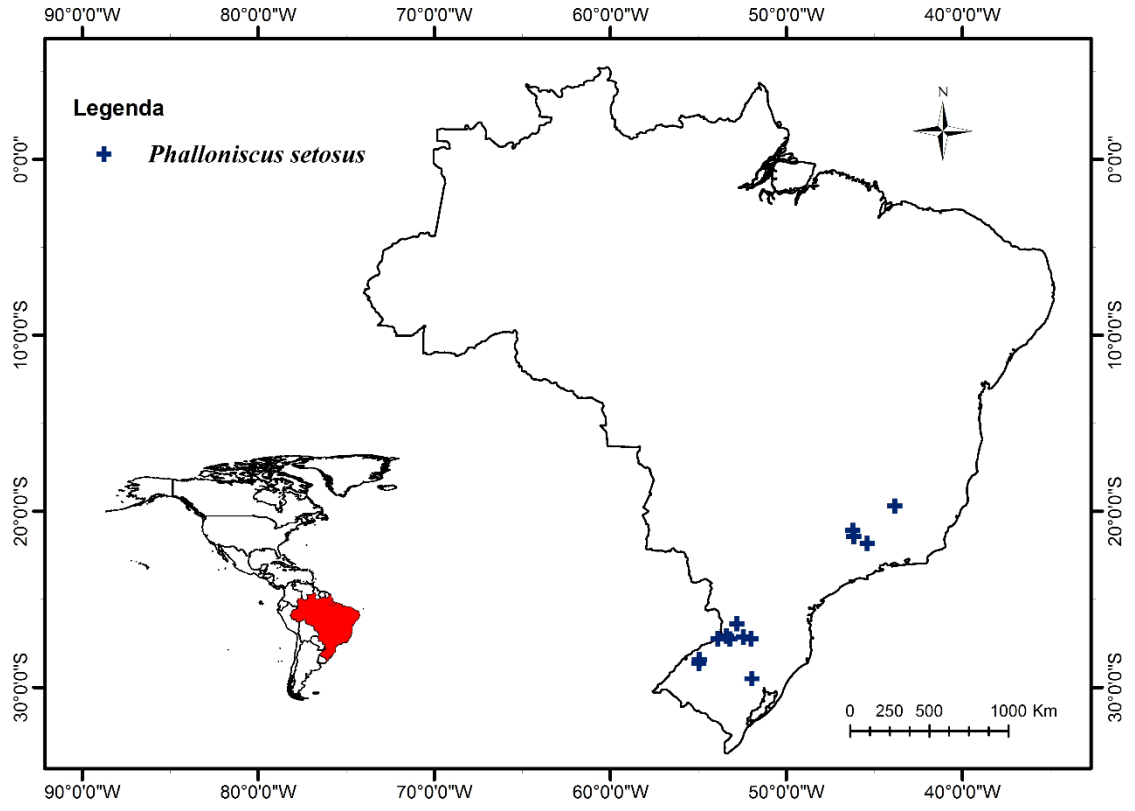


Figure 44. Distribution map of *N. setosus*.

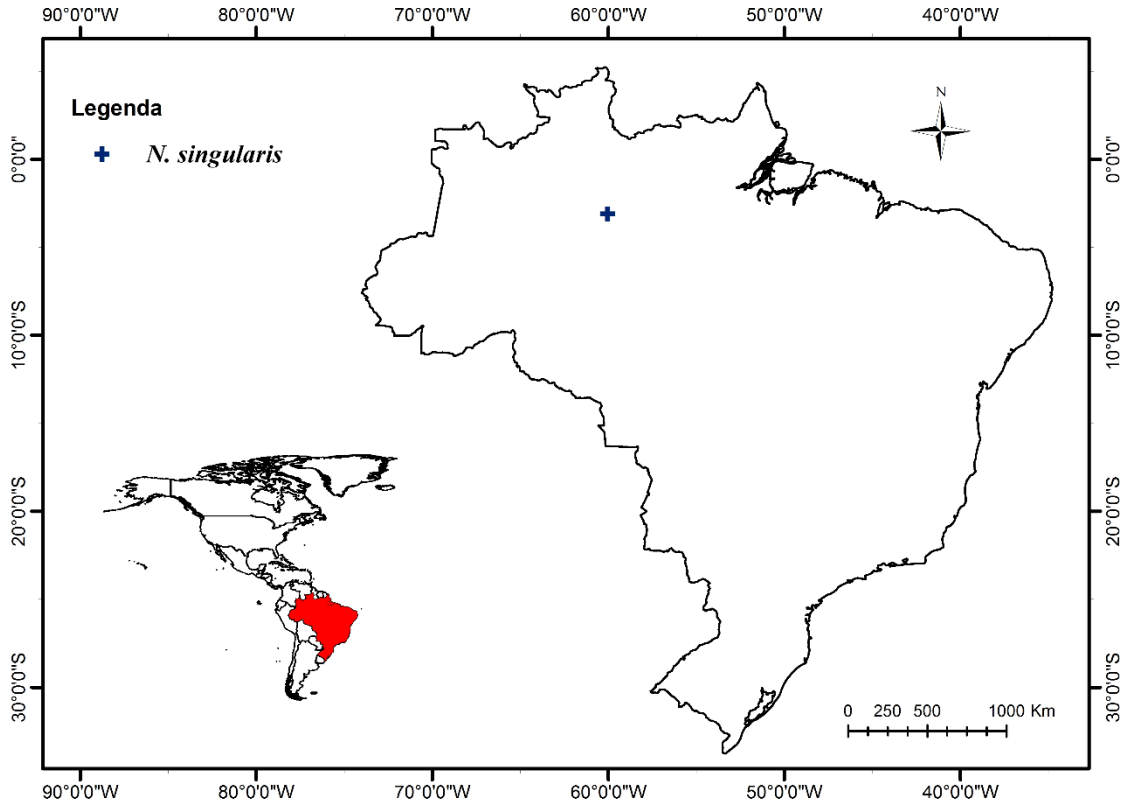


Figure 45. Distribution map of *I. singularis*.

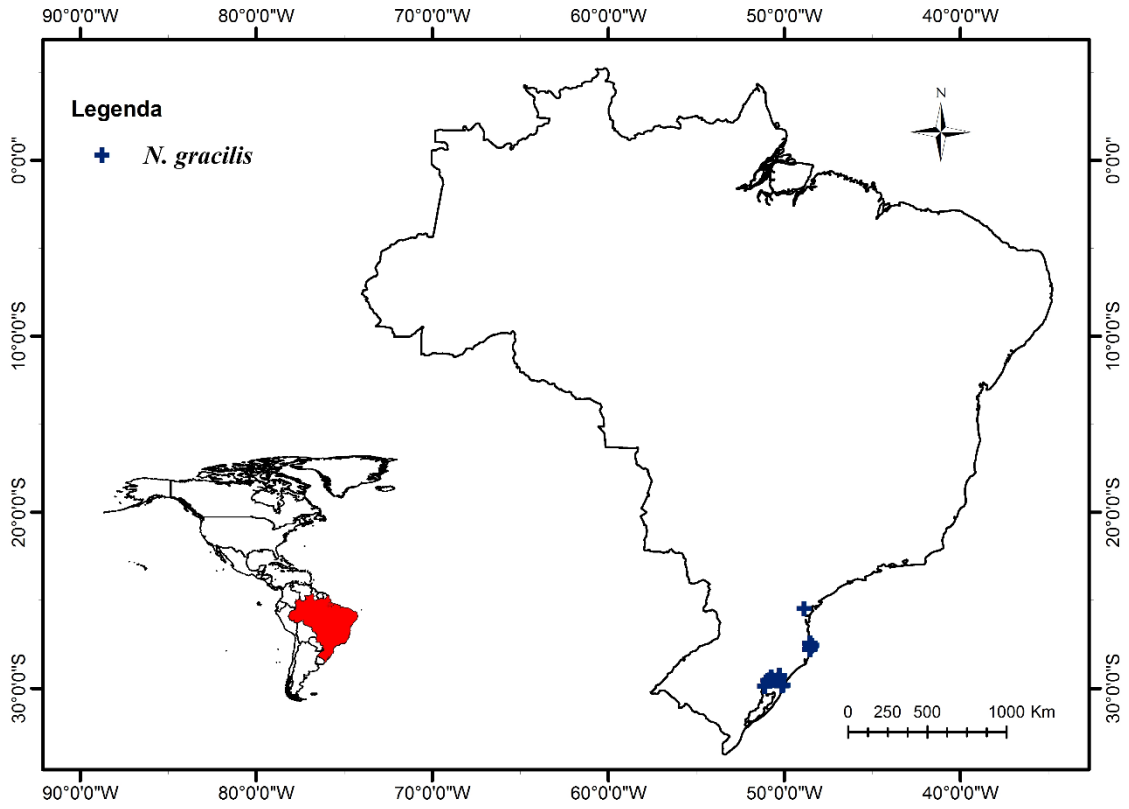


Figure 46. Distribution map of *D. gracilis*.

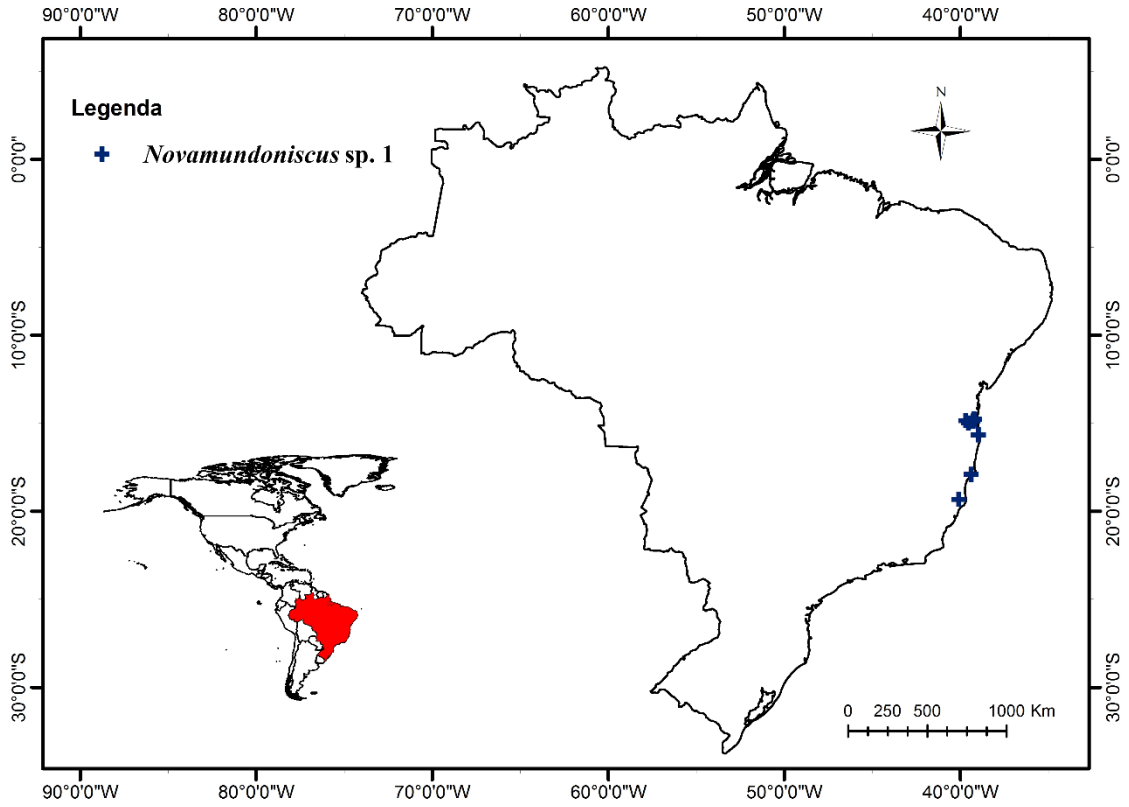


Figure 47. Distribution map of *Novamundoniscus* sp. 1.

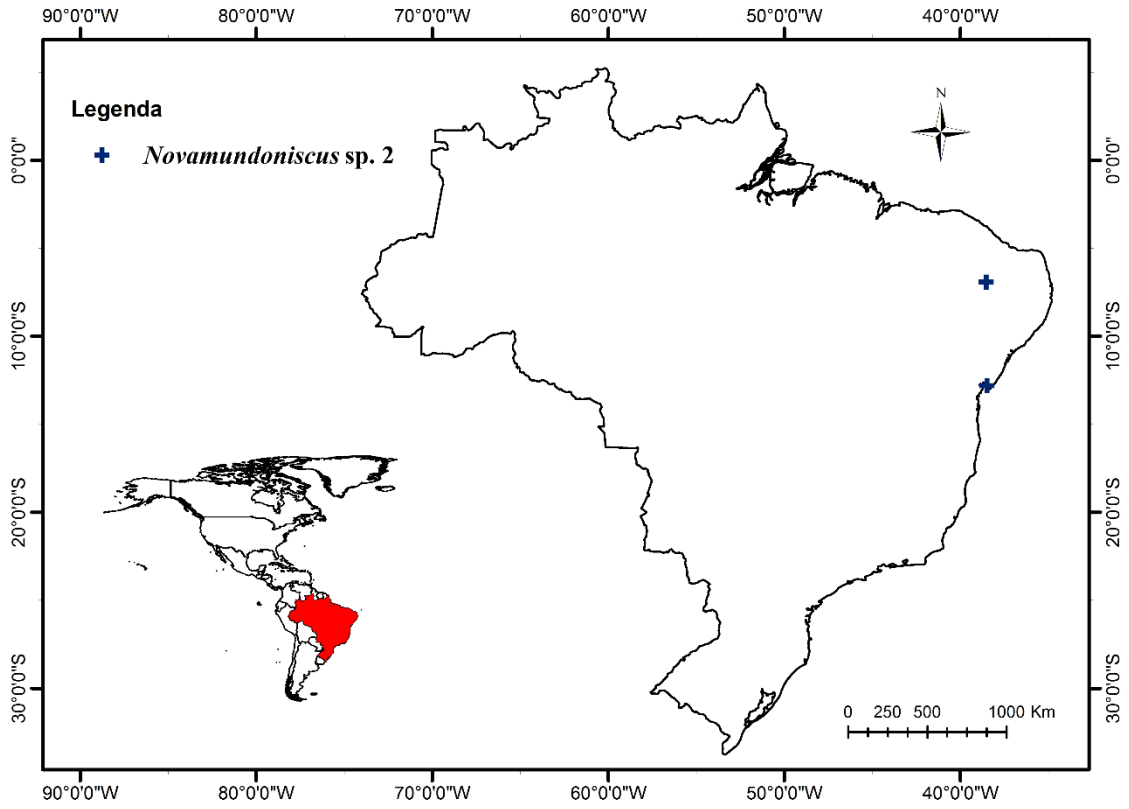


Figure 48. Distribution map of *Novamundoniscus* sp. 2.

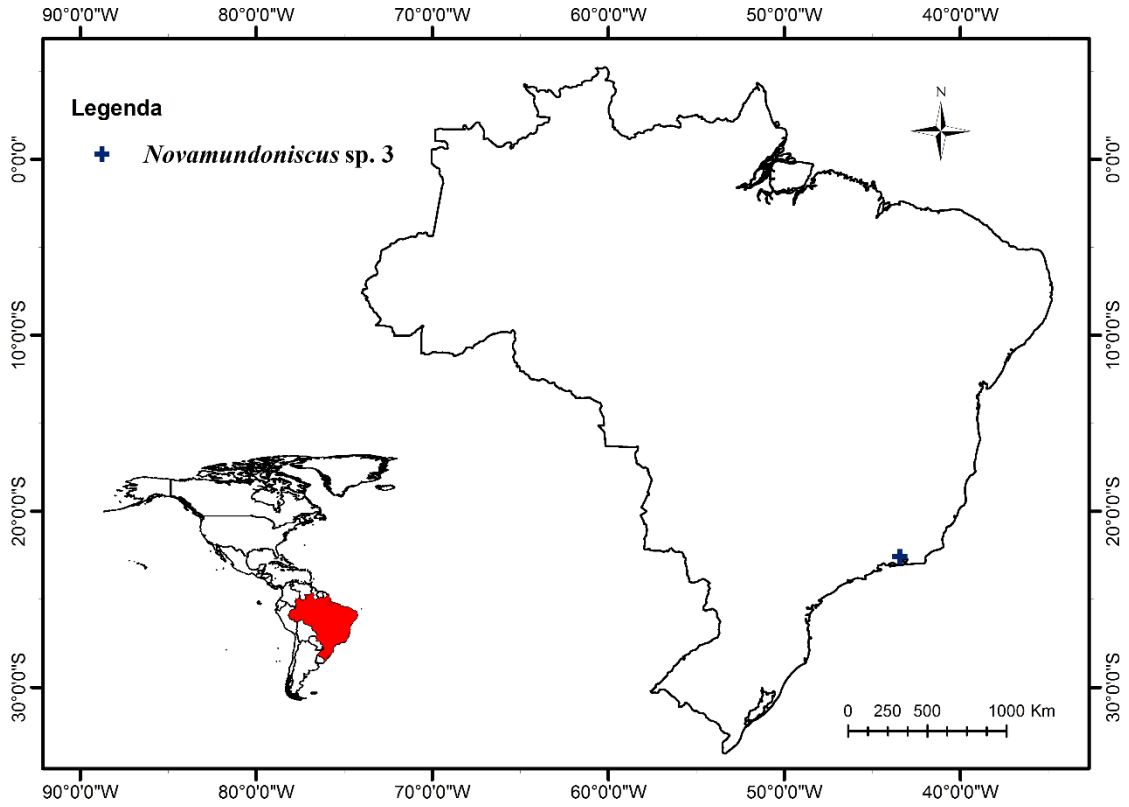


Figure 49. Distribution map of *Novamundoniscus* sp. 3.

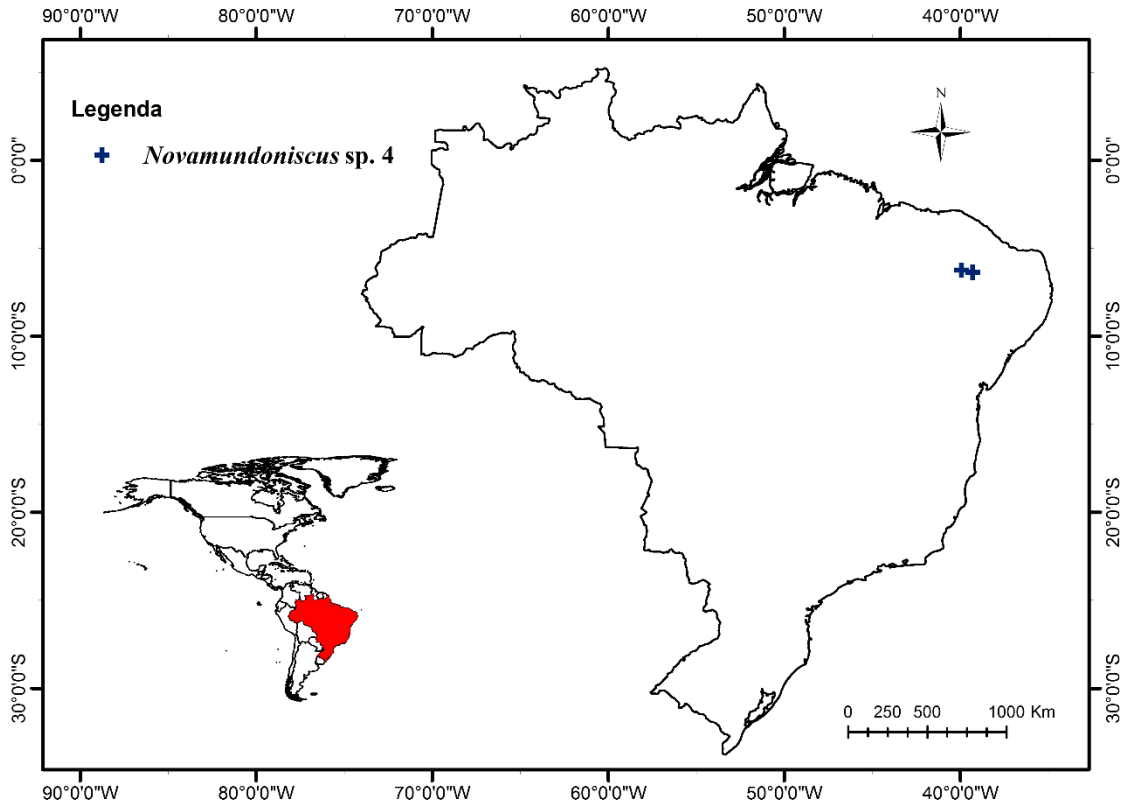


Figure 50. Distribution map of *Novamundoniscus* sp. 4.

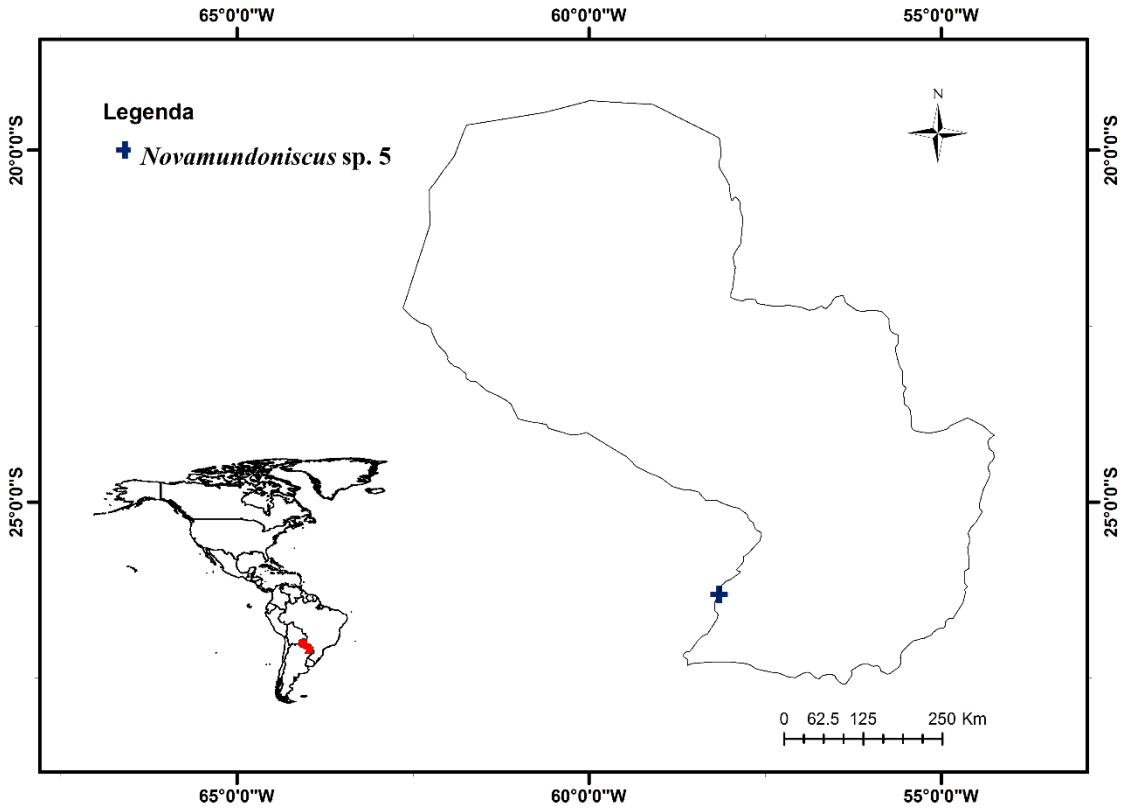


Figure 51. Distribution map of *Novamundoniscus* sp. 5.

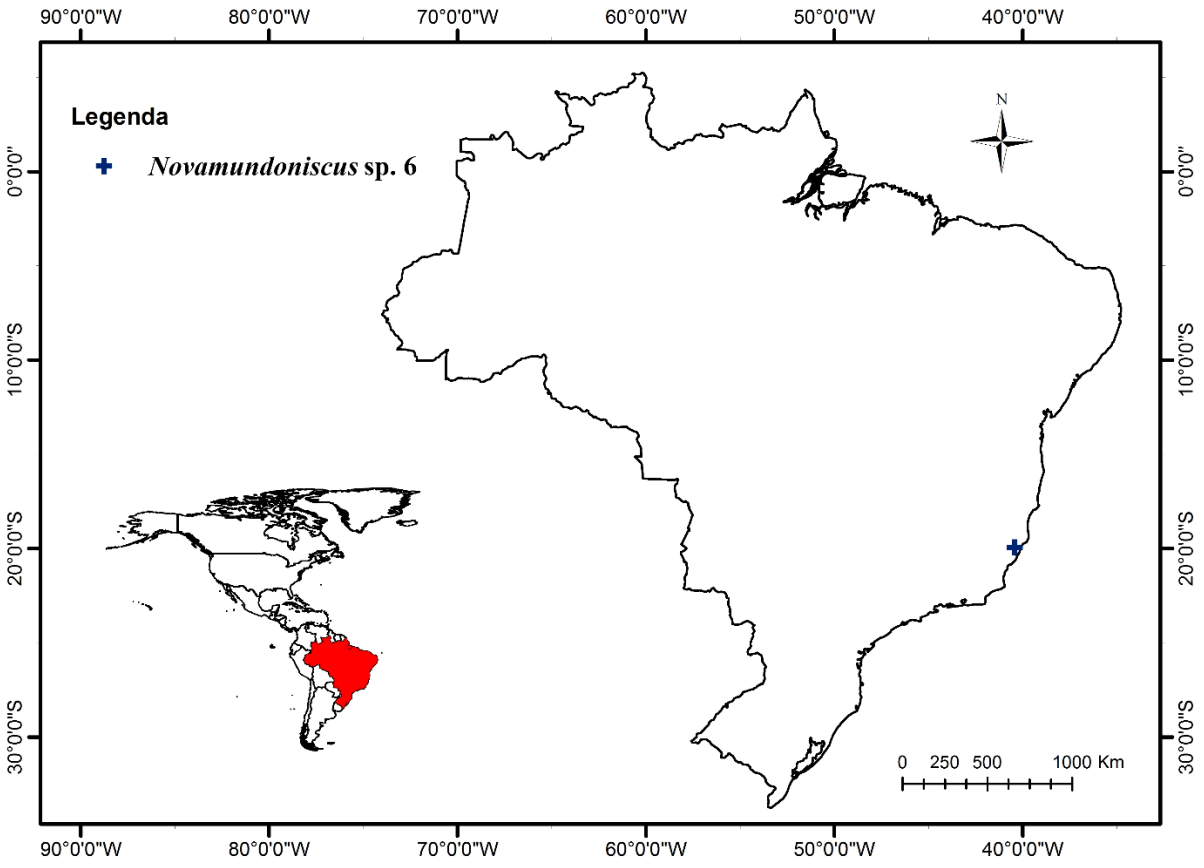


Figure 52. Distribution map of *Novamundoniscus* sp. 6.

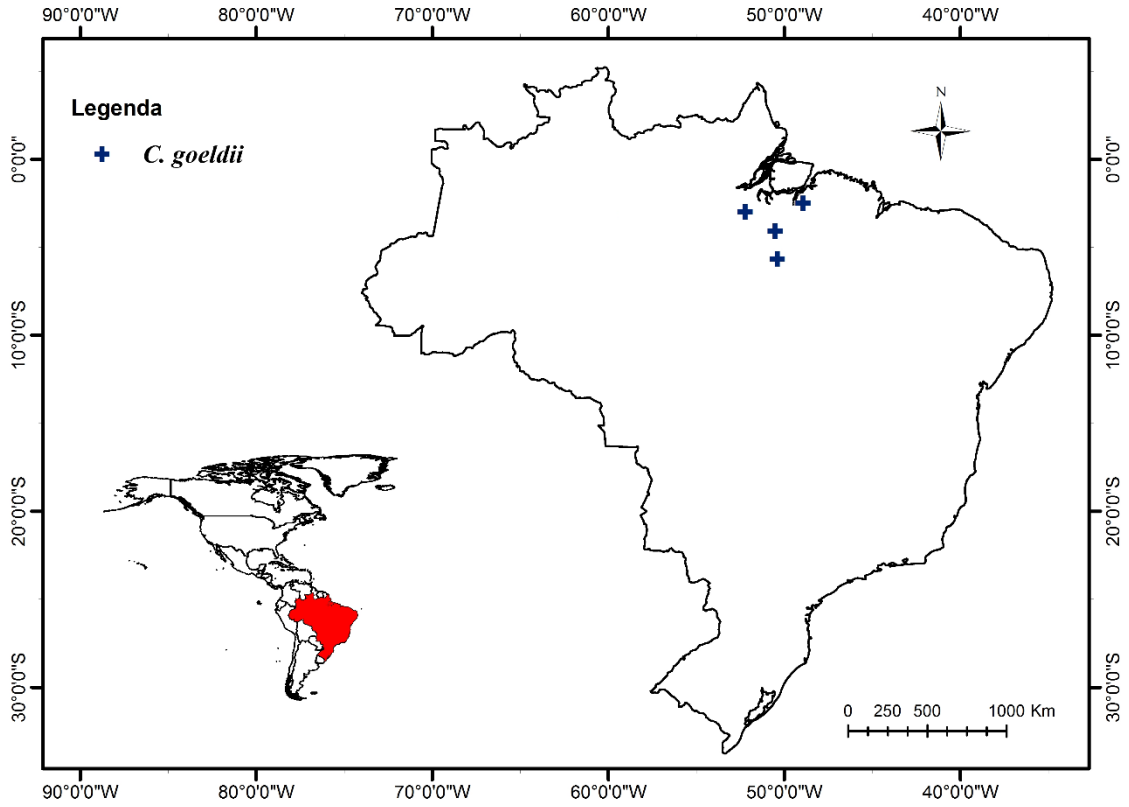


Figure 53. Distribution map of *C. goeldii*.

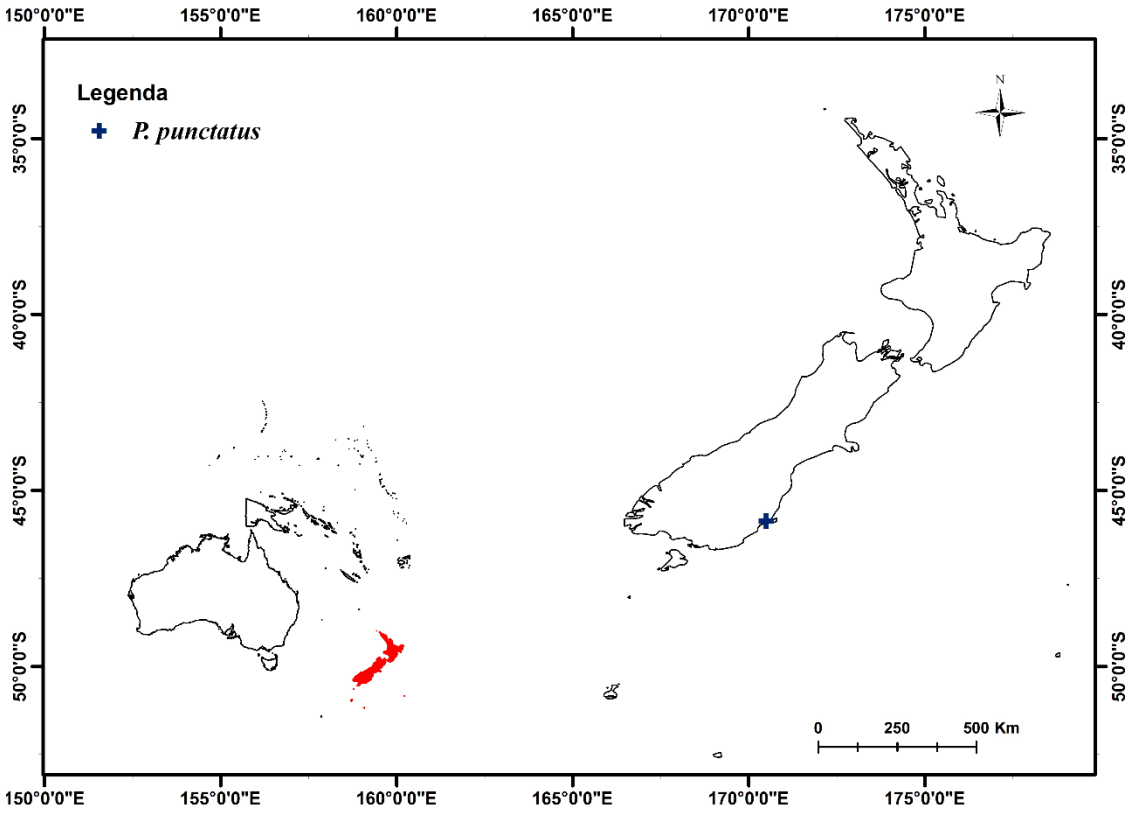


Figure 54. Distribution map of *P. punctatus.*

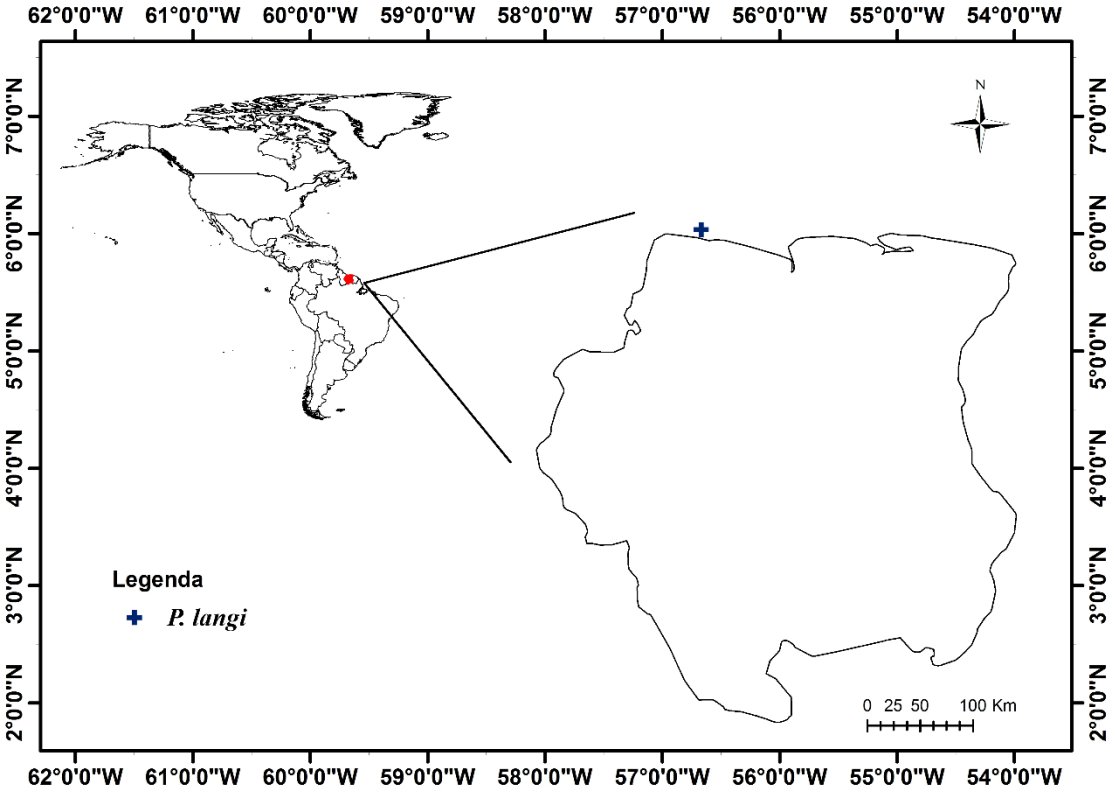


Figure 55. Distribution map of *P. punctatus.*

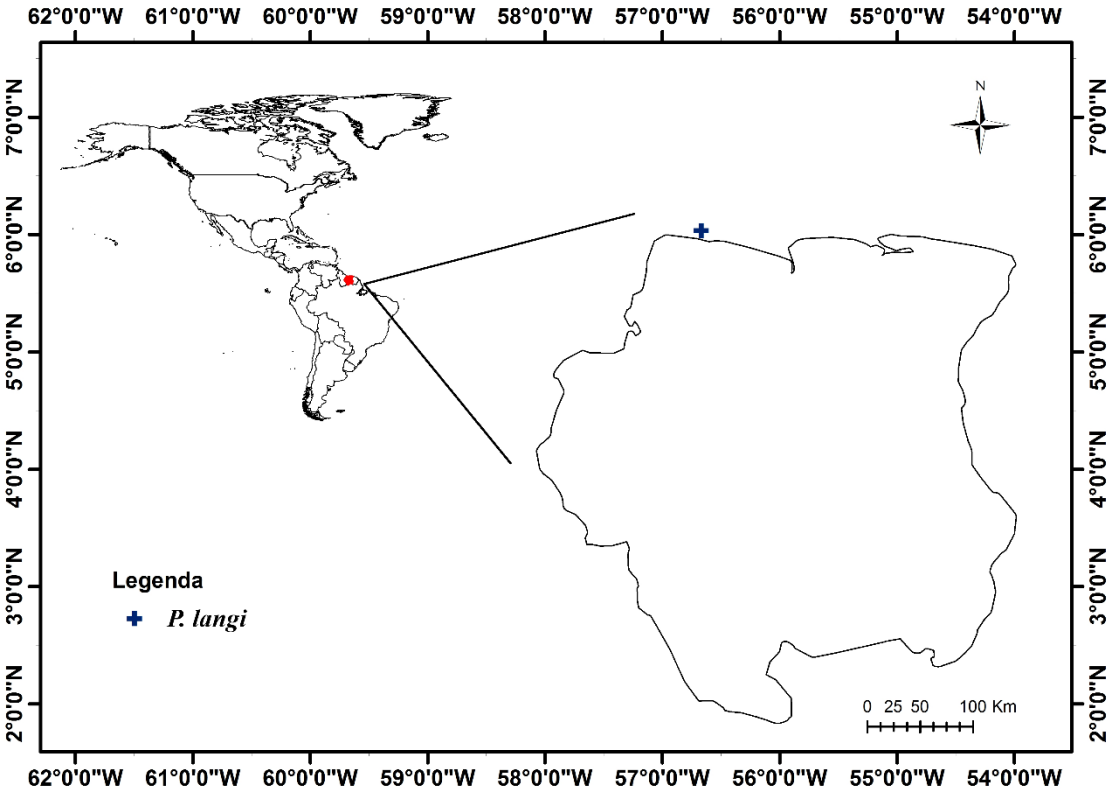


Figure 56. Distribution map of *P. langi.*

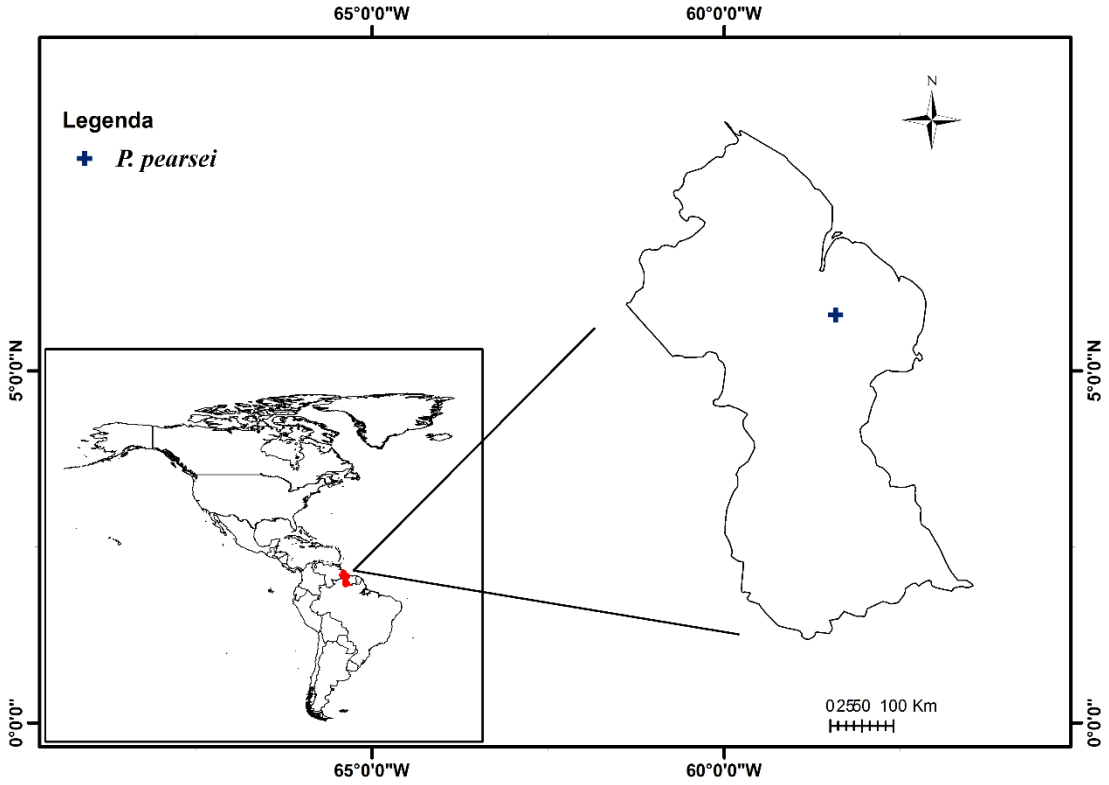


Figure 57. Distribution map of *P. pearsei.*

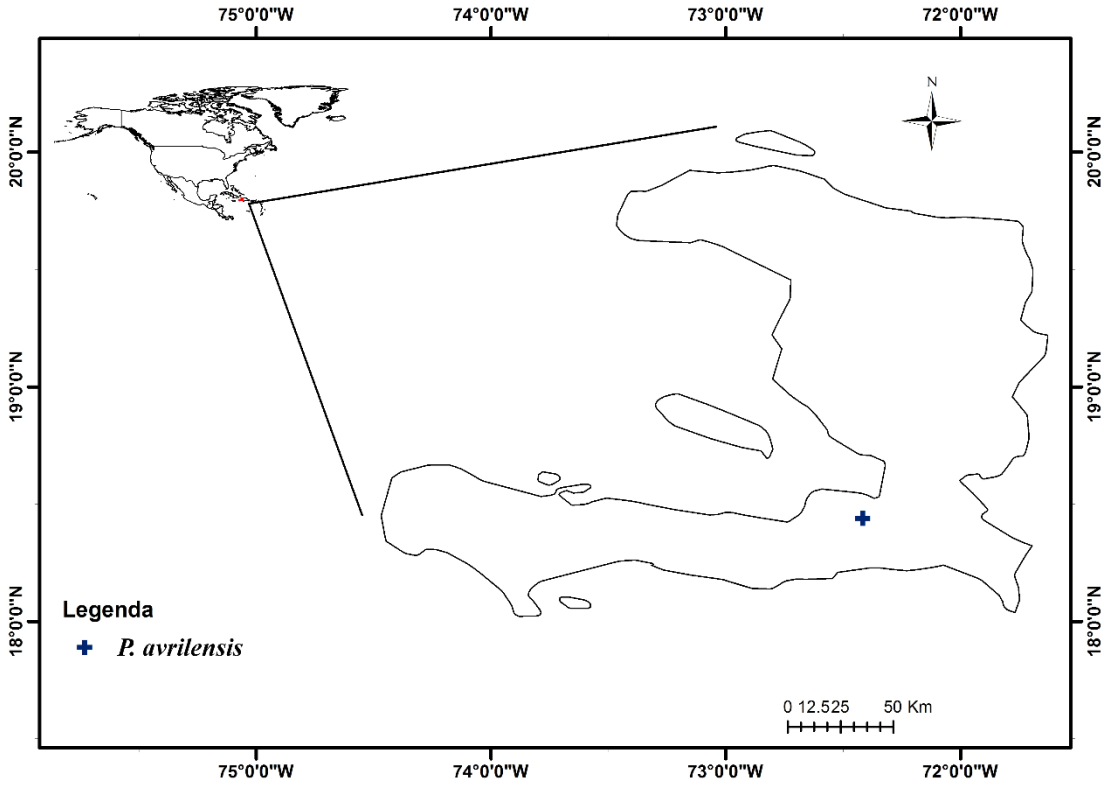


Figure 58. Distribution map of *P. avrilensis.*

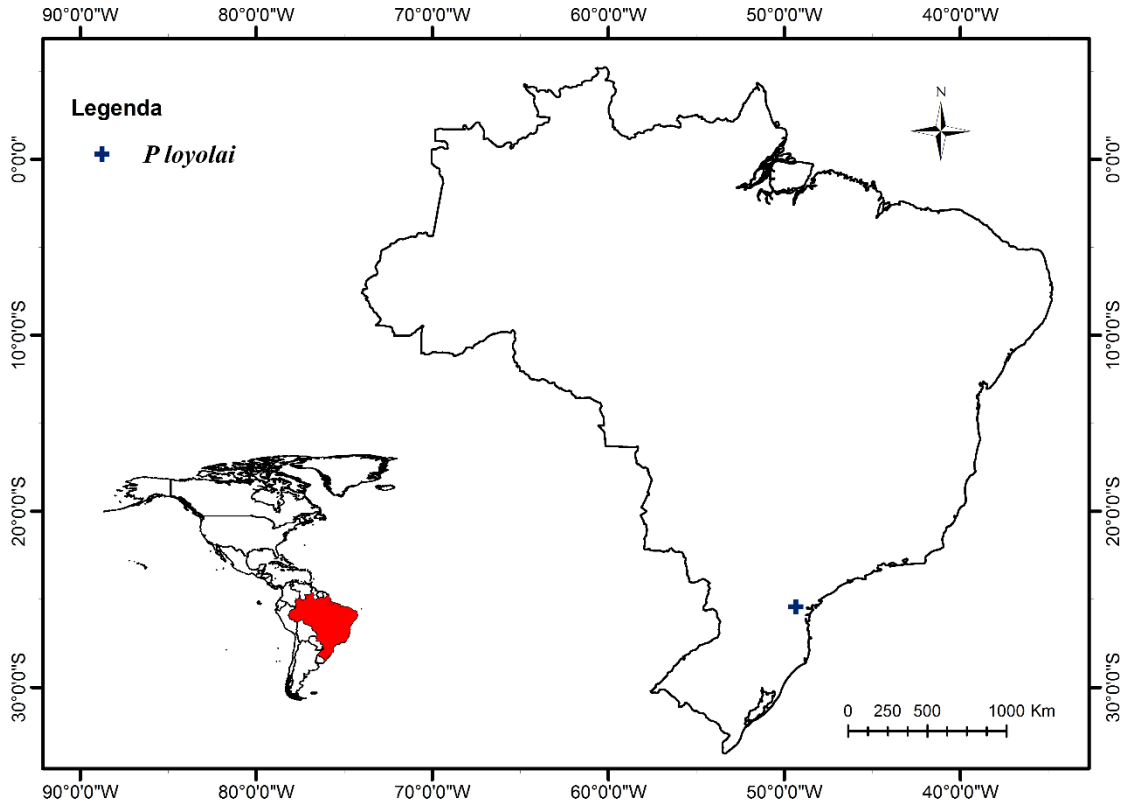


Figure 59. Distribution map of *P. loyolai.*

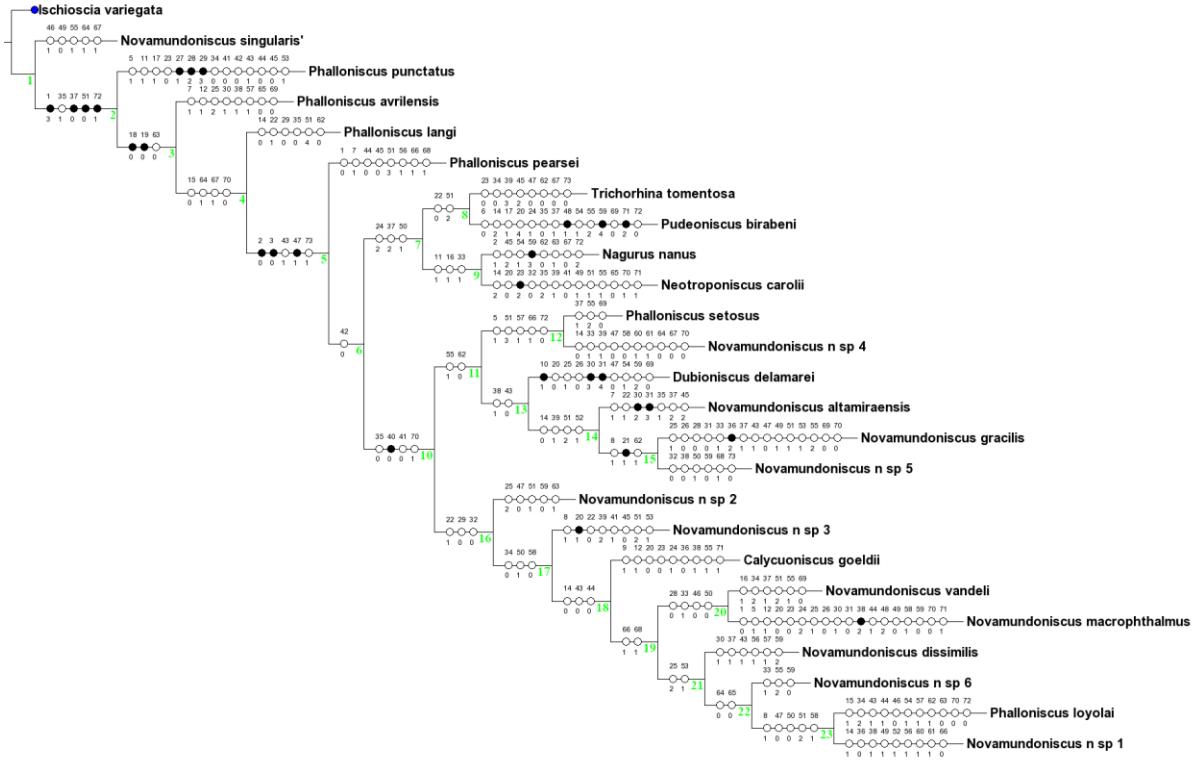


Figure 60. Final cladogram recovered with implied weightening with K = 3, showing synapomorphies and homoplasies.

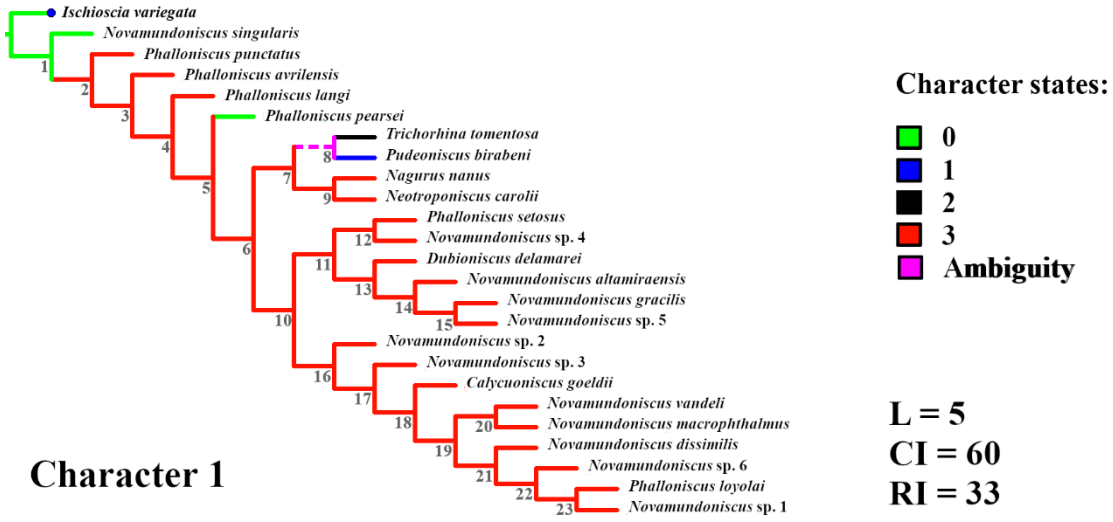


Figure 61. Optimization of character 1 on cladogram. Ecological category: (0) runner, (1) roller, (2) creeper, (3) clinger.

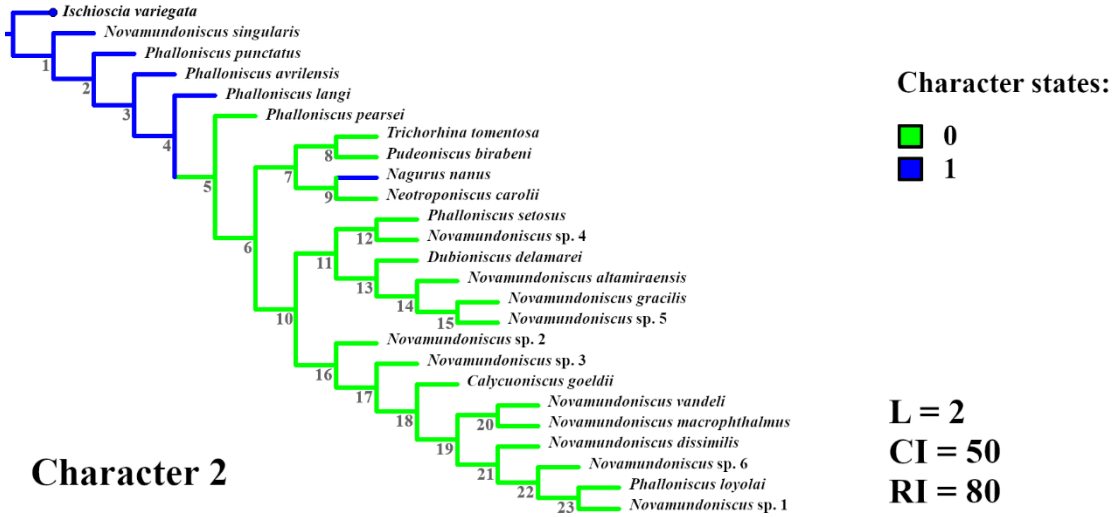


Figure 62. Optimization of character 2 on cladogram. Scale-setae on dorsal cuticular surface: (0) fan-shaped scale setae, (1) trichorn scale setae.

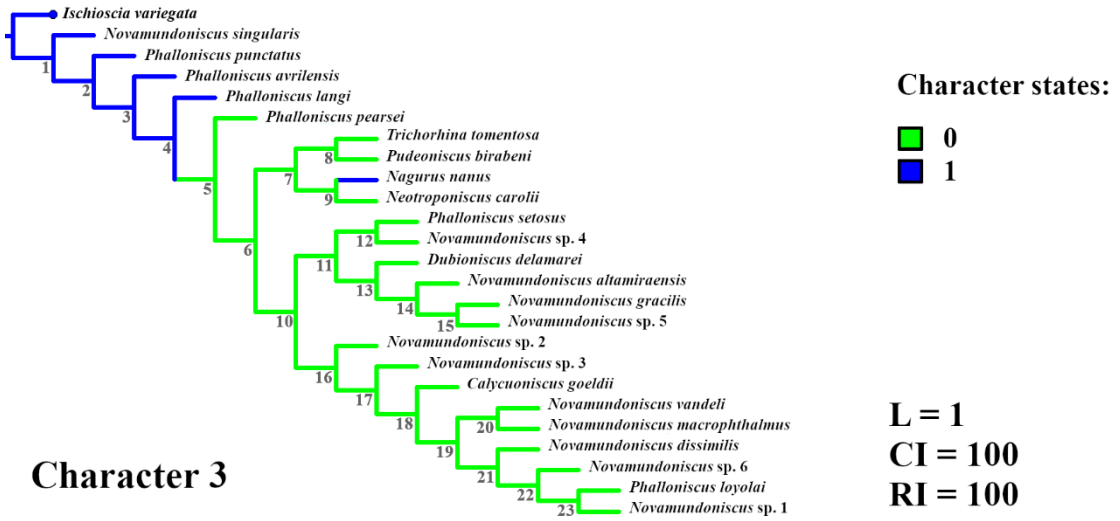


Figure 63. Optimization of character 3 on cladogram. Pereonites, noduli laterales: (0) discernible; (1) not discernible.

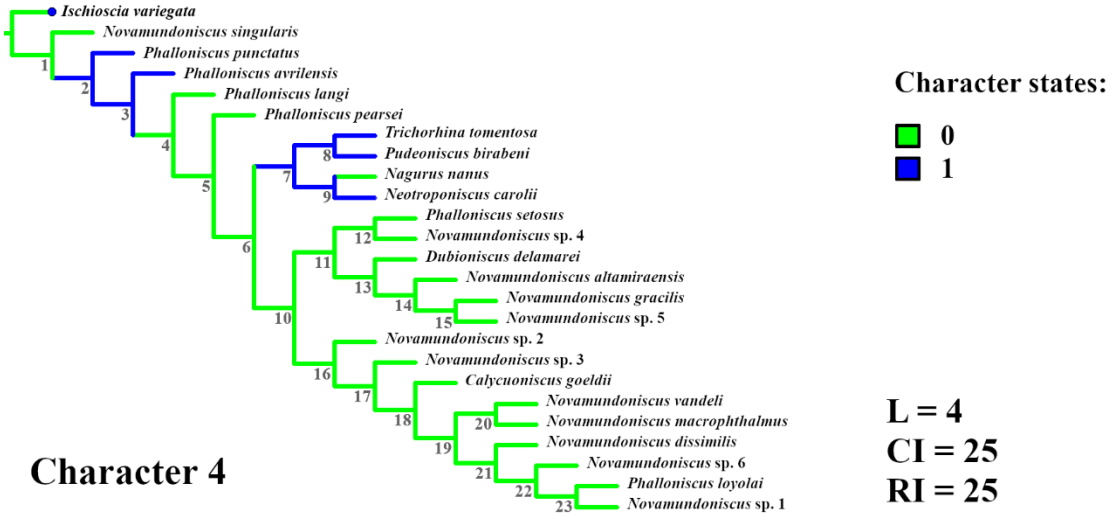


Figure 64. Optimization of character 4 on cladogram. Dorsum, dorsal surface: (0) smooth; (1) tuberculate.

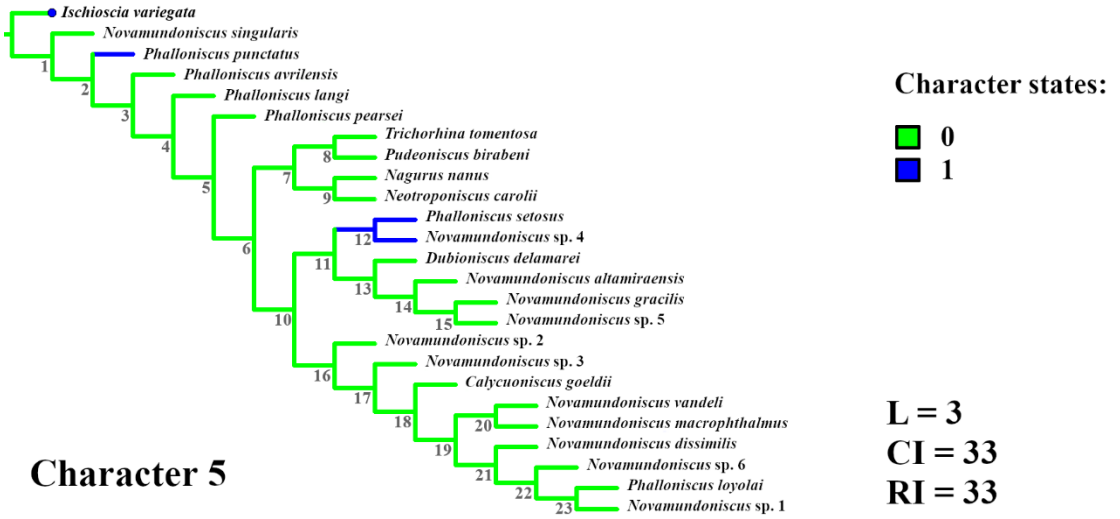


Figure 65. Optimization of character 5 on cladogram. Dorsum, gland pores: (0) absent; (1) present.

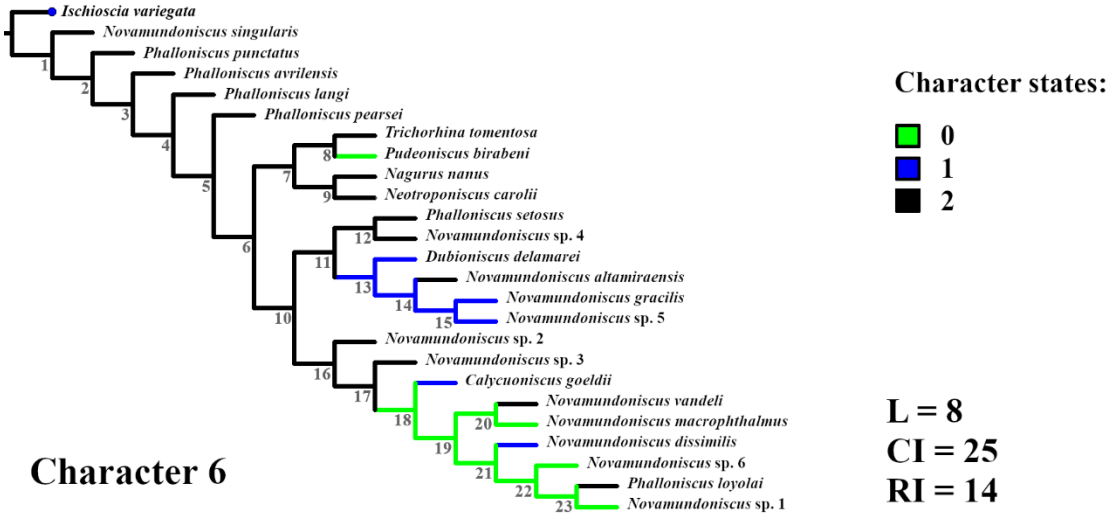


Figure 66. Optimization of character 6 on cladogram. Pereonites, epimeron development of posterior corners: (0) pereonite 7 directed backwards; (1) pereonites 6 and 7 directed backwards; (2) pereonites 5 to 7 directed backwards.

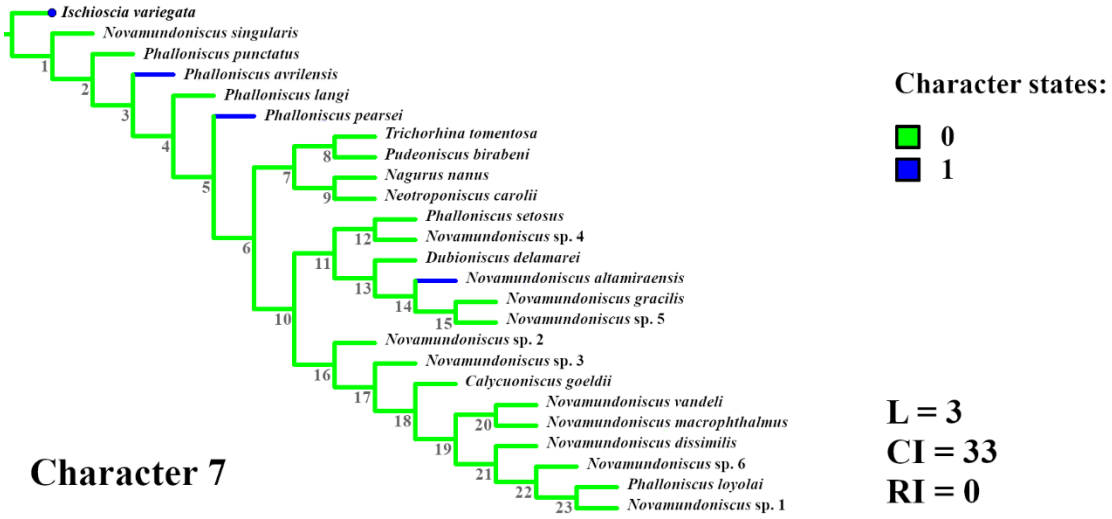


Figure 67. Optimization of character 7 on cladogram. Pleonite 5, epimera length relative to pleotelson distal margin: (0) shorter than distal margin of pleotelson; (1) reaching or surpassing distal margin of pleotelson.

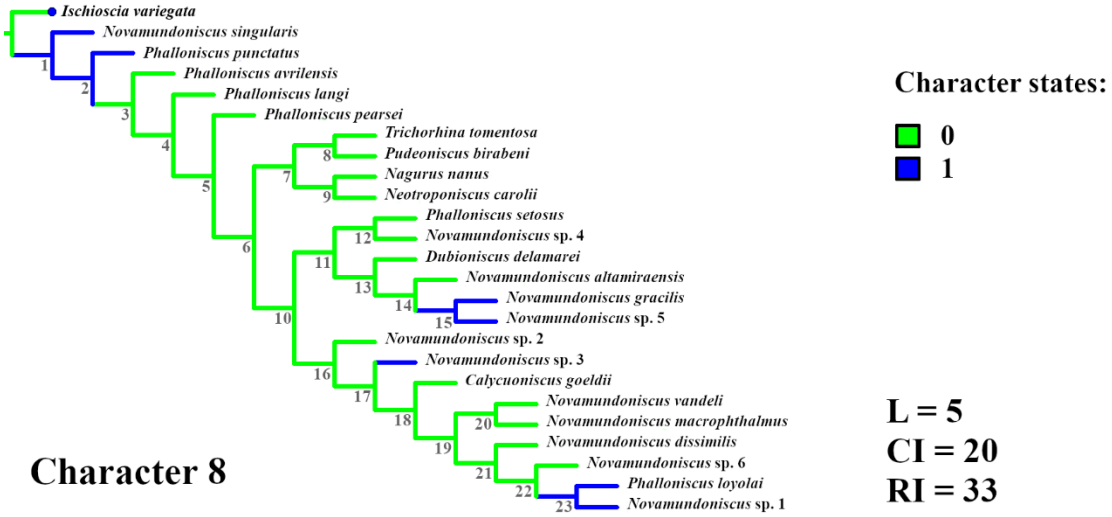


Figure 68. Optimization of character 8 on cladogram. Pleotelson, lateral margins, shape: (0) concave; (1) straight to slightly convex.

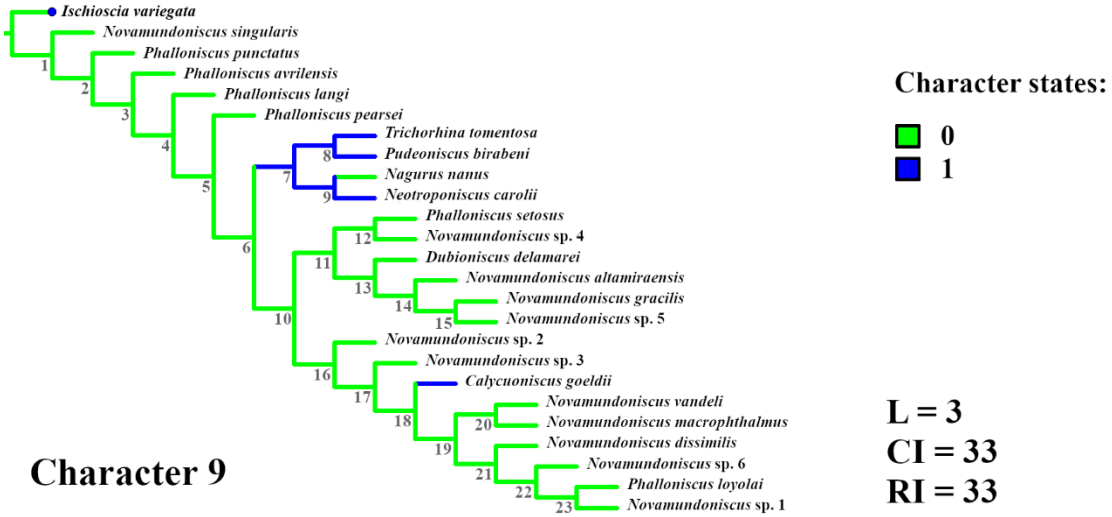


Figure 69. Optimization of character 9 on cladogram. Pleotelson, distal margin, shape: (0) acute; (1) round.

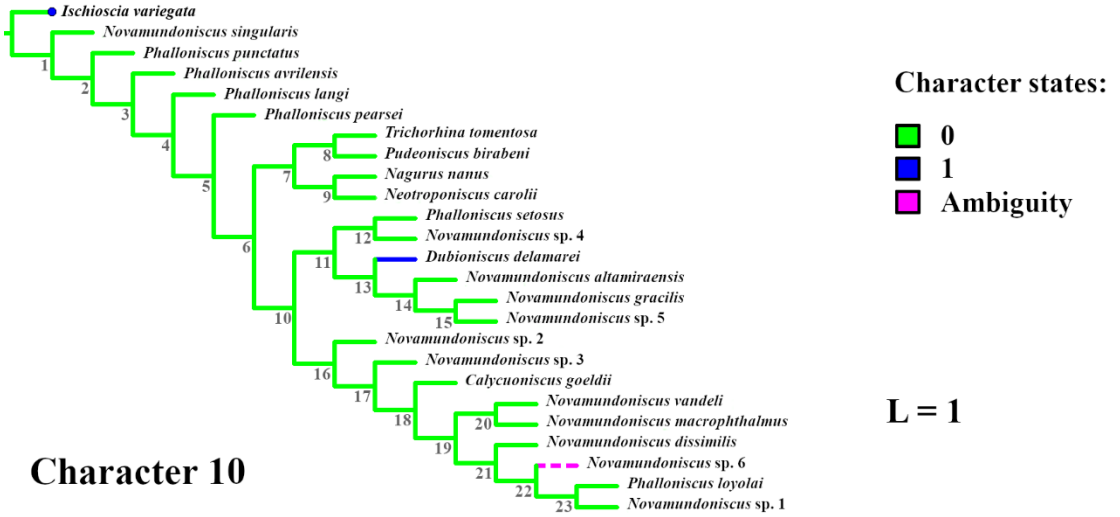


Figure 70. Optimization of character 10 on cladogram. Cephalothorax, dorsal view, with V-shaped depression on anterior margin: (0) absent; (1) present.


Figure 71. Optimization of character 11 on cladogram. Cephalothorax, dorsal view, frontal lobe: (0) absent; (1) present.

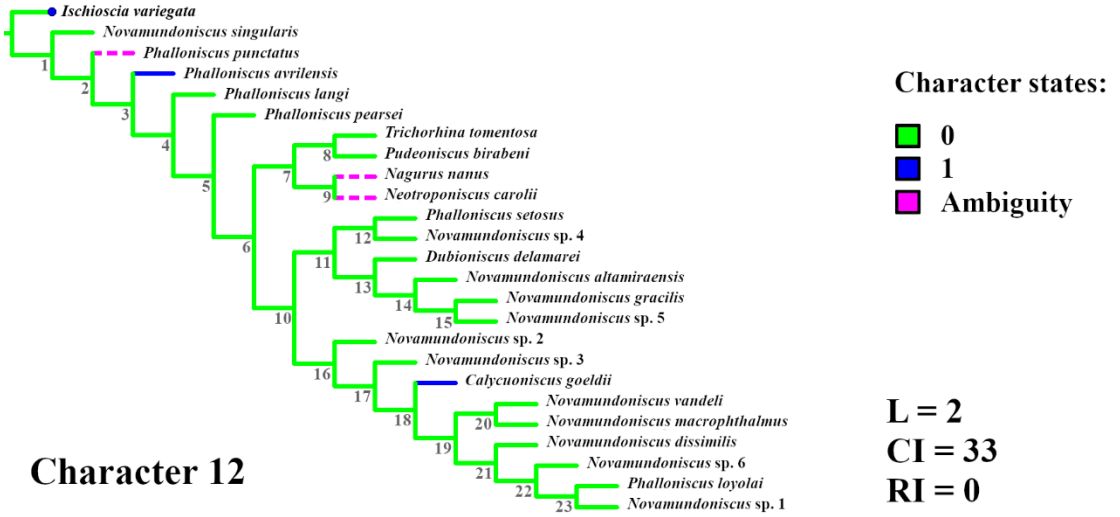


Figure 72. Optimization of character 12 on cladogram. Cephalothorax, dorsal view (species without frontal lobe), anterior margin: (0) round; (1) triangular.

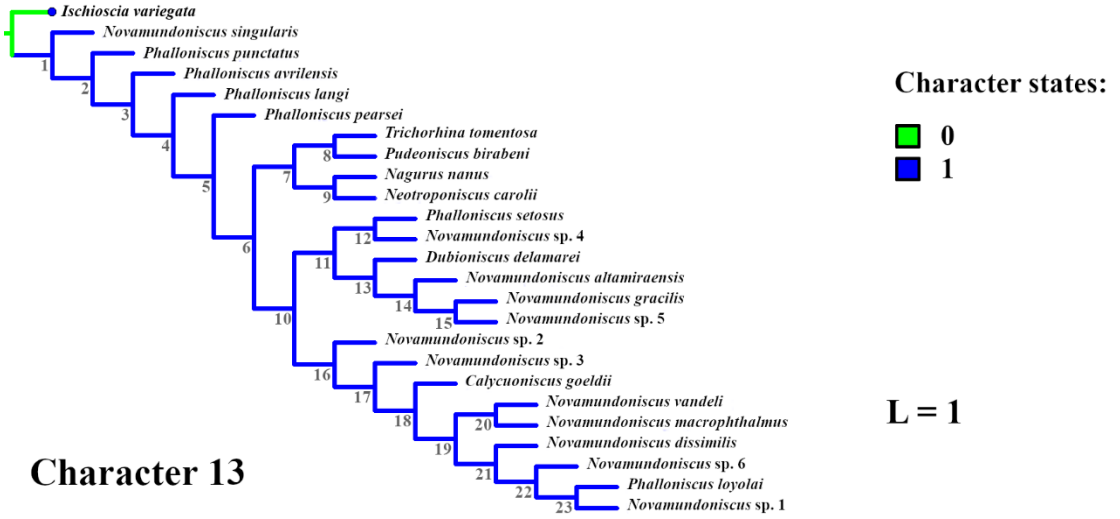


Figure 73. Optimization of character 13 on cladogram. Cephalothorax, dorsal view, lateral lobes: (0) absent; (1) present.

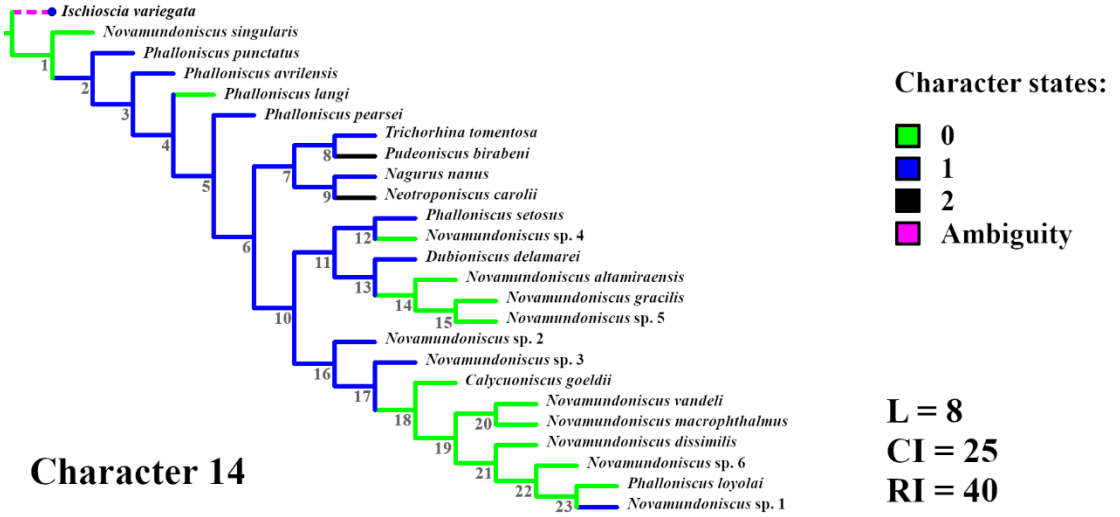


Figure 74. Optimization of character 14 on cladogram. Cephalothorax, dorsal view, species with lateral lobes, shape: (0) triangular; (1) round; (2) quadrangular.

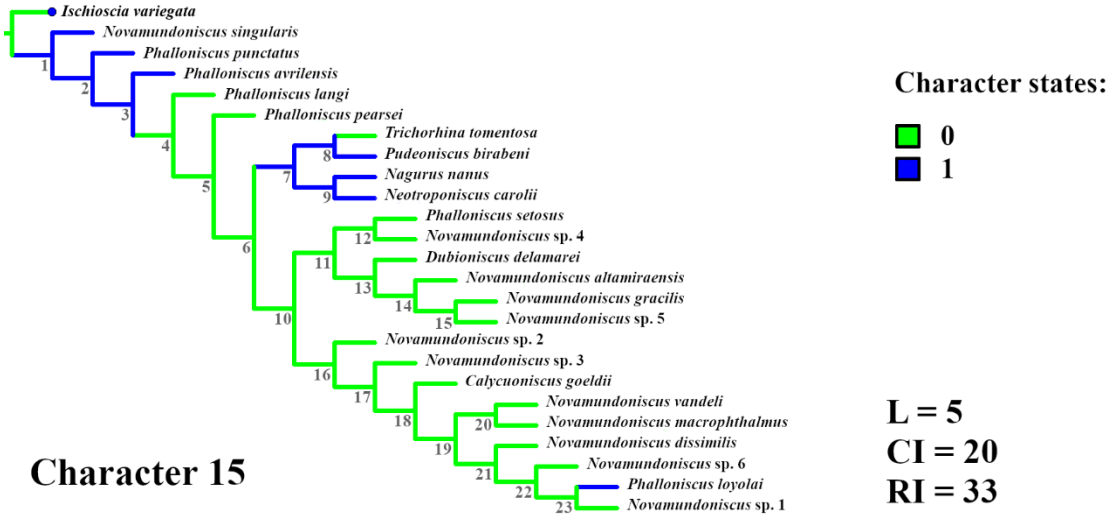


Figure 75. Optimization of character 15 on cladogram. Cephalothorax, frontal view, frontal line: (0) absent; (1) present.

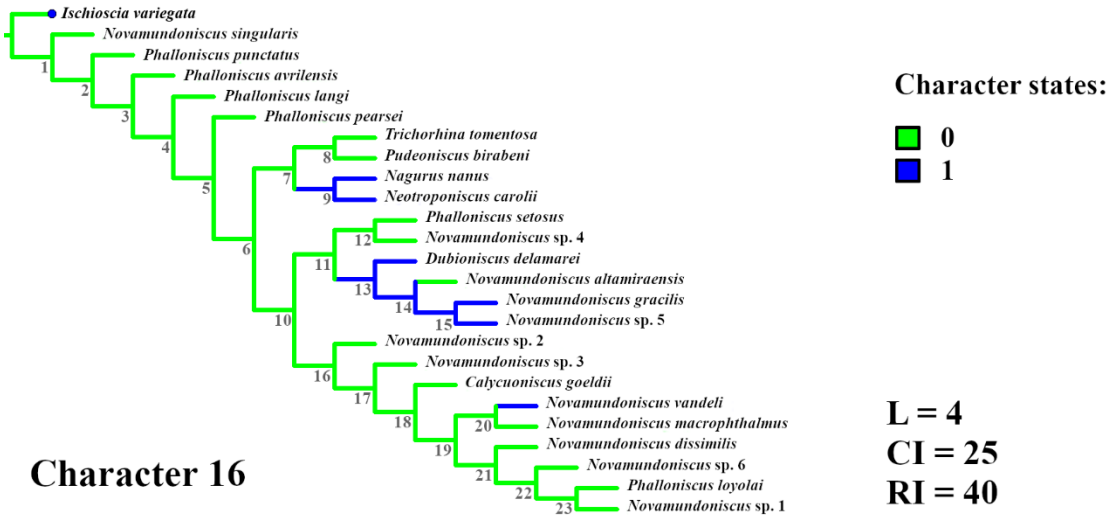


Figure 76. Optimization of character 16 on cladogram. Cephalothorax, frontal view, supraantennal line: (0) present; (1) absent.

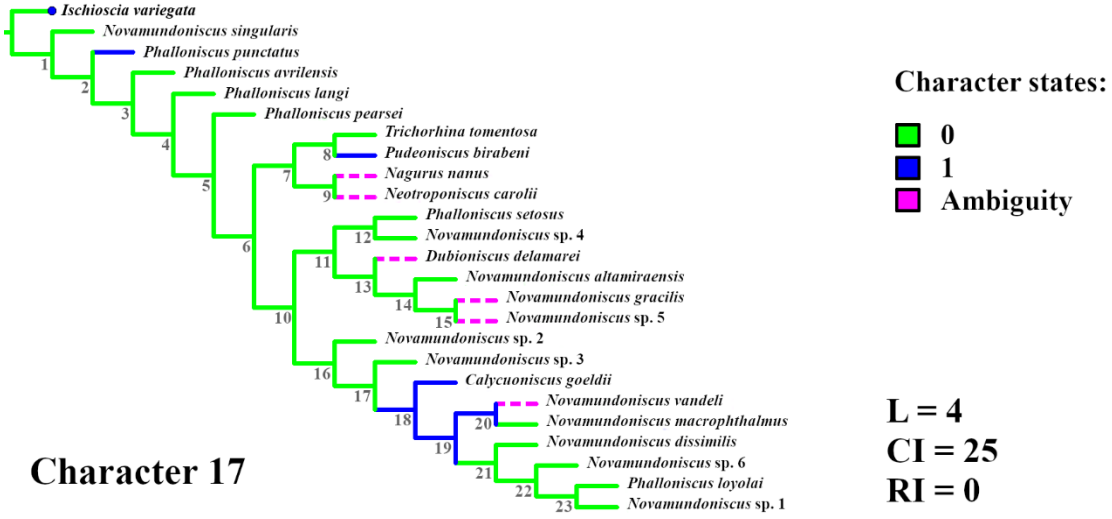


Figure 77. Optimization of character 17 on cladogram. Cephalothorax, frontal view, supraantennal line shape (species with supraantennal line well defined): (0) sinuous; (1) straight.


Figure 78. Optimization of character 18 on cladogram. Cephalothorax, frontal view, eyes disposition: (0) not protruding eyes; (1) protruding eyes.


Figure 79. Optimization of character 19 on cladogram. Cephalothorax, frontal view, eyes disposition: (0) not protruding eyes; (1) protruding eyes.

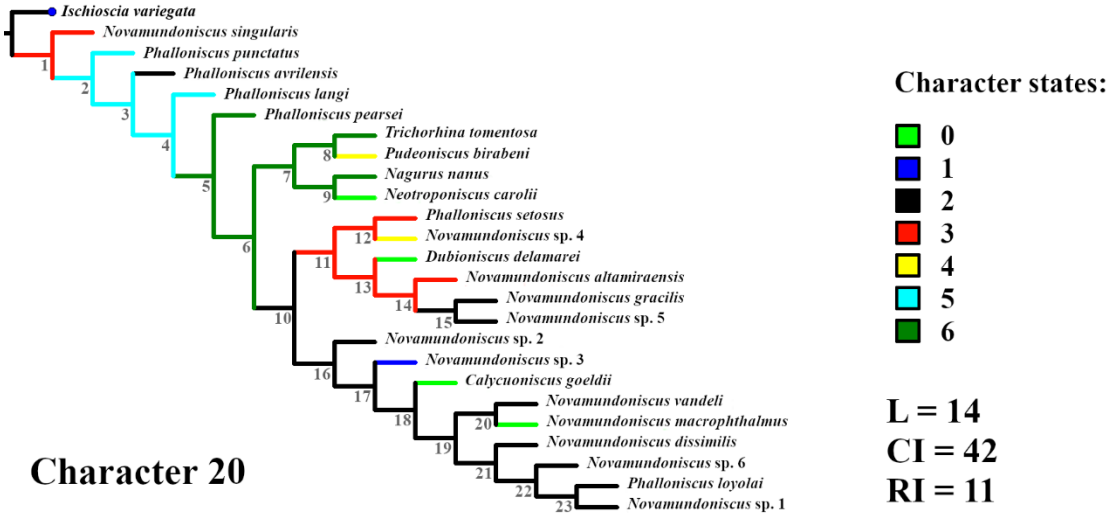


Figure 80. Optimization of character 20 on cladogram. Antennula, number of aesthetascs: (0) 4; (1) 5; (2) 6; (3) 7; (4) 8; (5) 10; (6) 12.

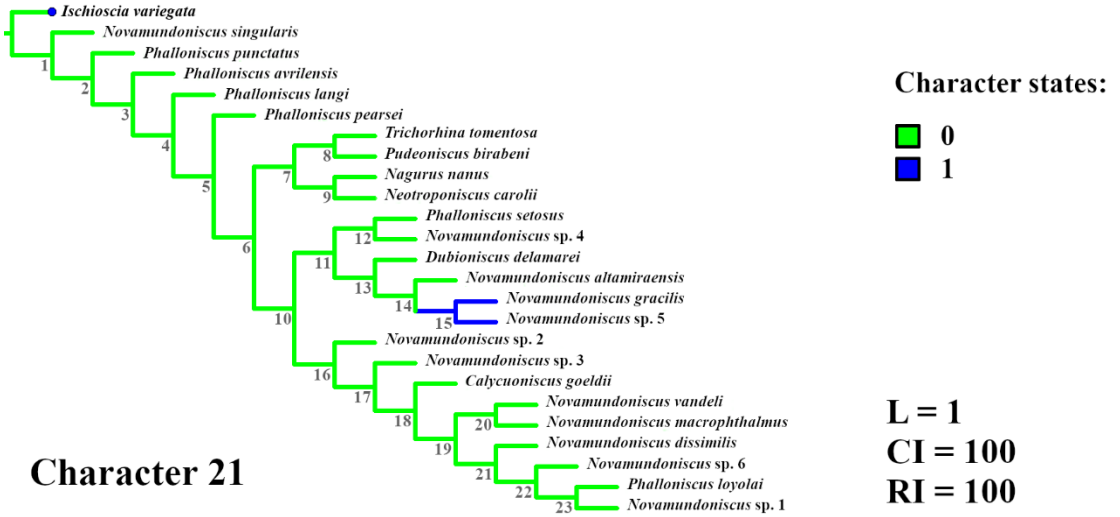


Figure 81. Optimization of character 21 on cladogram. Antennula, distal article, apical tip: (0) absent; (1) present.

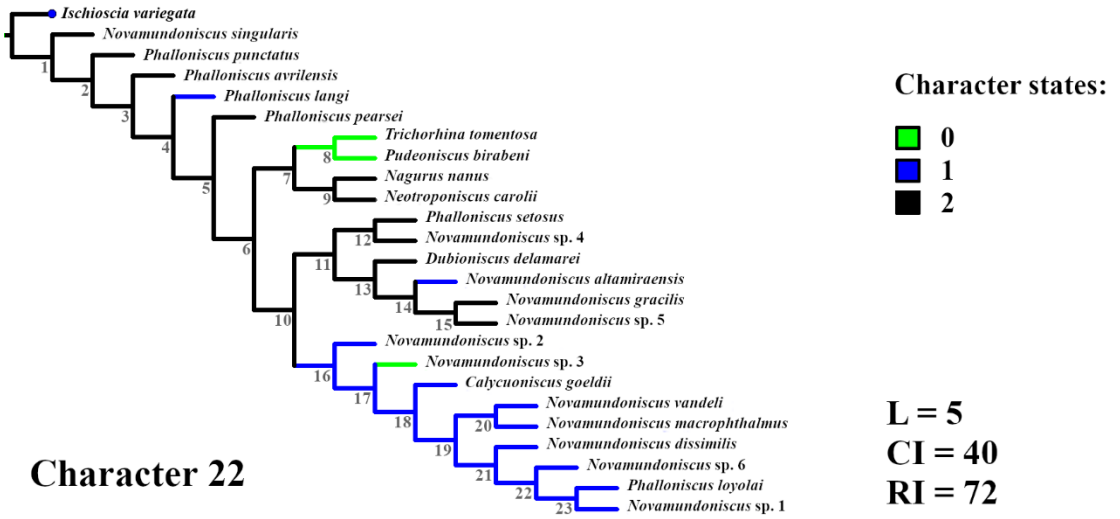


Figure 82. Optimization of character 22 on cladogram. Antenna, range related to pereonites in dorsal view: (0) pereonite 1; (1) pereonite 2; (2) pereonite 3 and beyond.

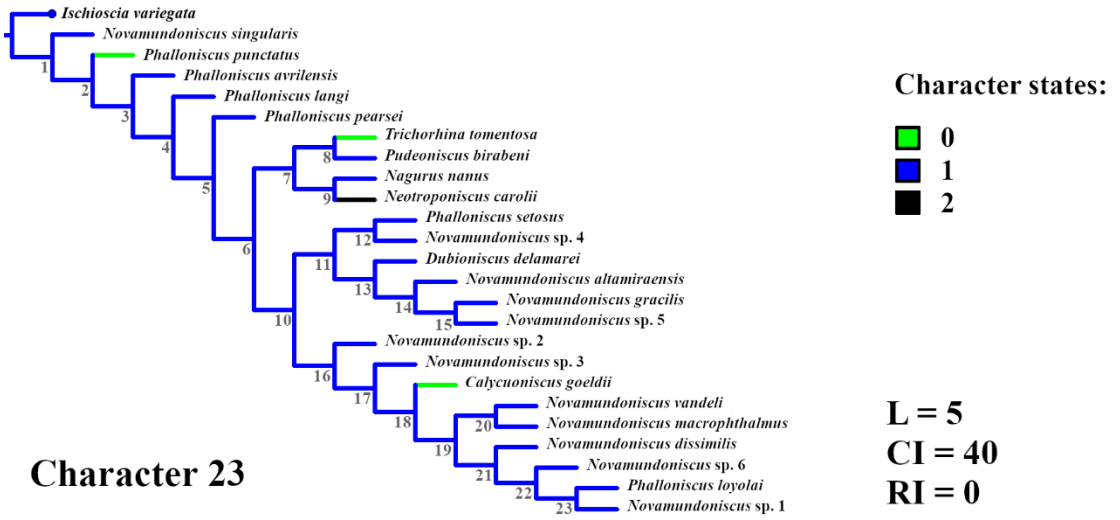


Figure 83. Optimization of character 23 on cladogram. Antenna, fifth peduncle article related to flagellum: (0) subequal; (1) longer (2) much longer (about twice longer than flagellum).

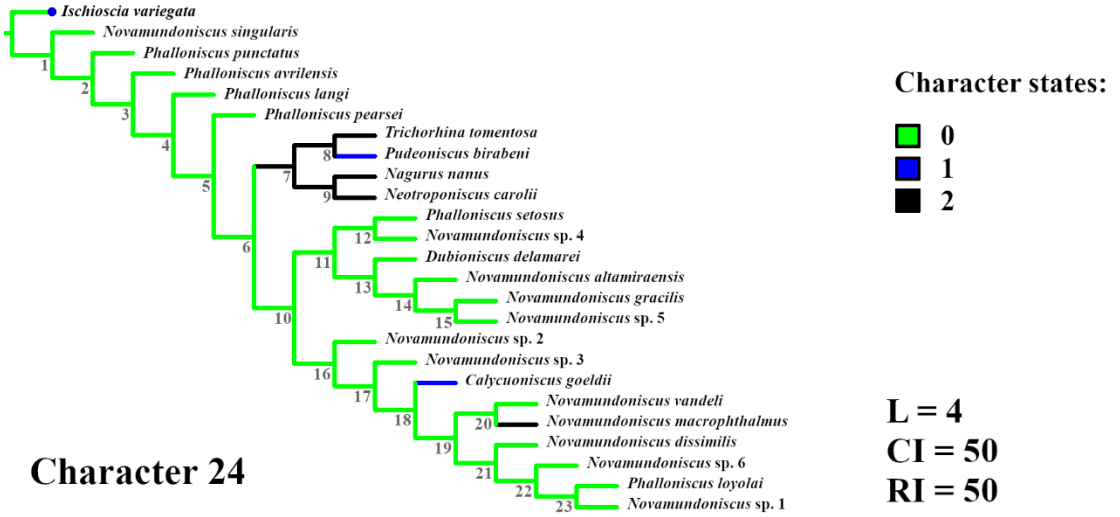


Figure 84. Optimization of character 24 on cladogram. Antenna, flagellum, number of articles: (0) three; (1) three, medial and distal articles delimited by an immovable suture; (2) two.

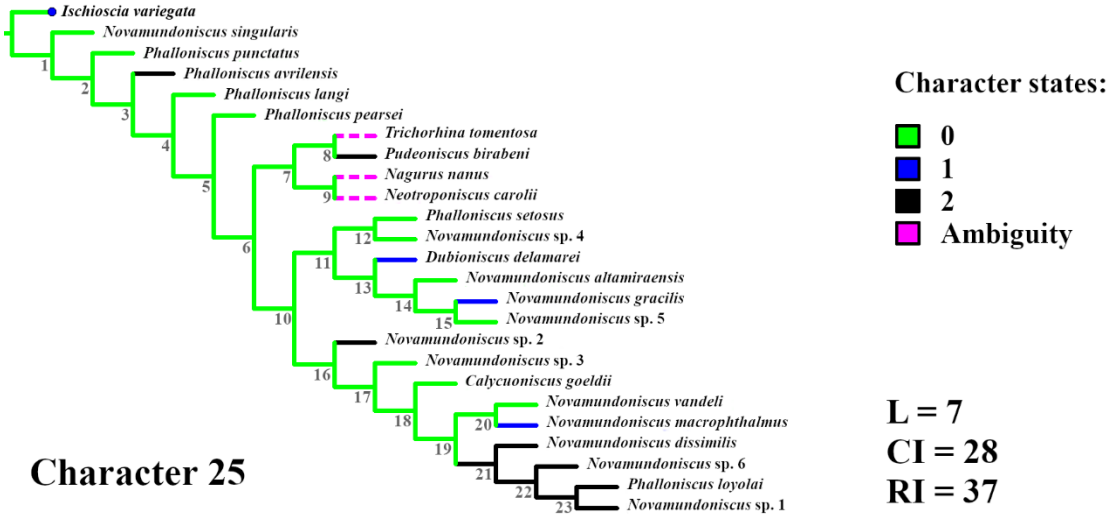


Figure 85. Optimization of character 25 on cladogram. Antenna, flagellum triarticulated, length of third article related to second: (0) third the longest; (1) second the longest; (2) subequal.

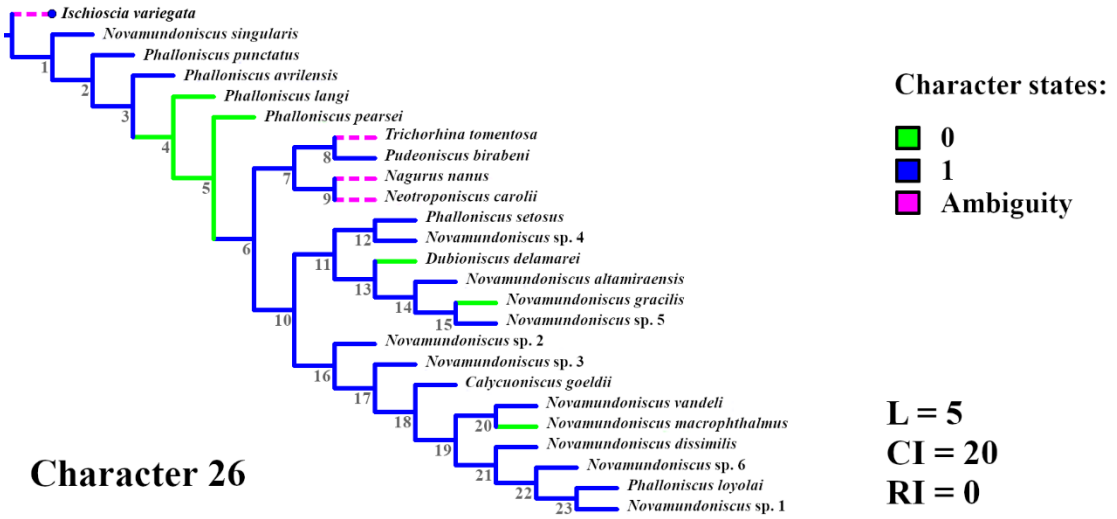


Figure 86. Optimization of character 26 on cladogram. Antenna, flagellum triarticulated, length of third article related to first and second articles: (0) third article reduced, related to the other two; (1) third article is not the shortest.

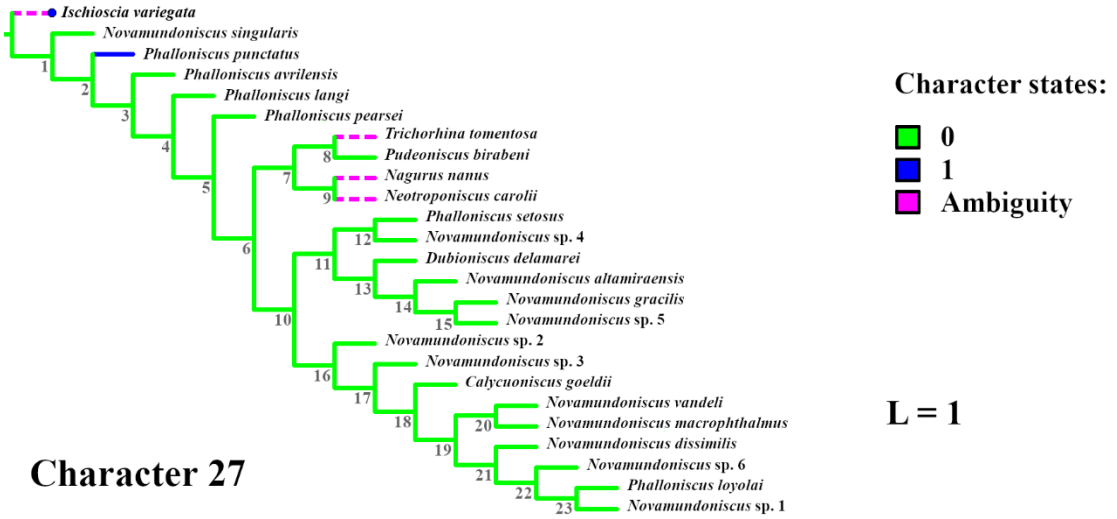


Figure 87. Optimization of character 27 on cladogram. Antenna, flagellum triarticulated, length of third article related to first and second articles: (0) third article reduced, related to the other two; (1) third article is not the shortest.

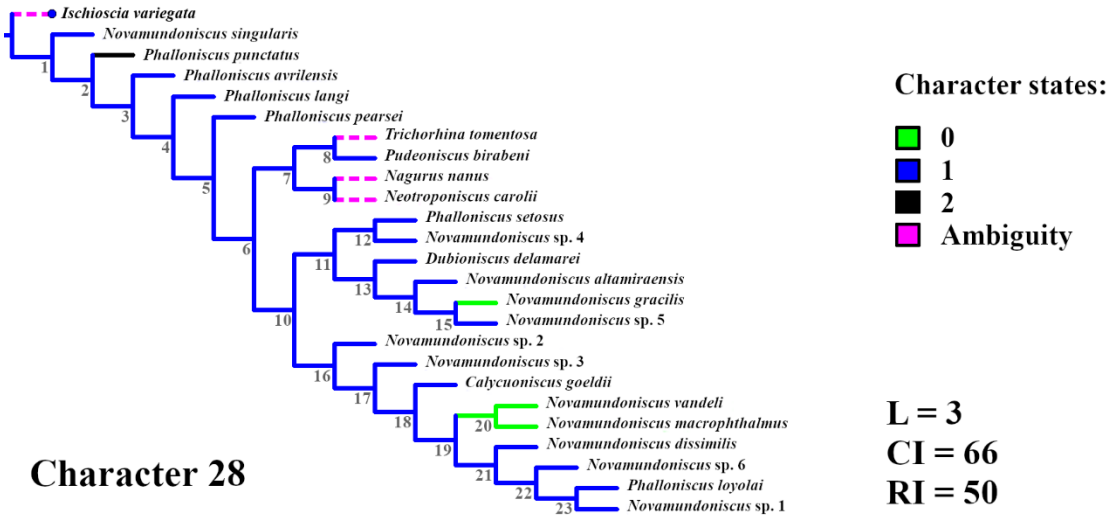


Figure 88. Optimization of character 28 on cladogram. Antenna, flagellum triarticulated, second article, insertion of rows of asthetascs: (0) one medial row; (1) one distal row; (2) two rows.

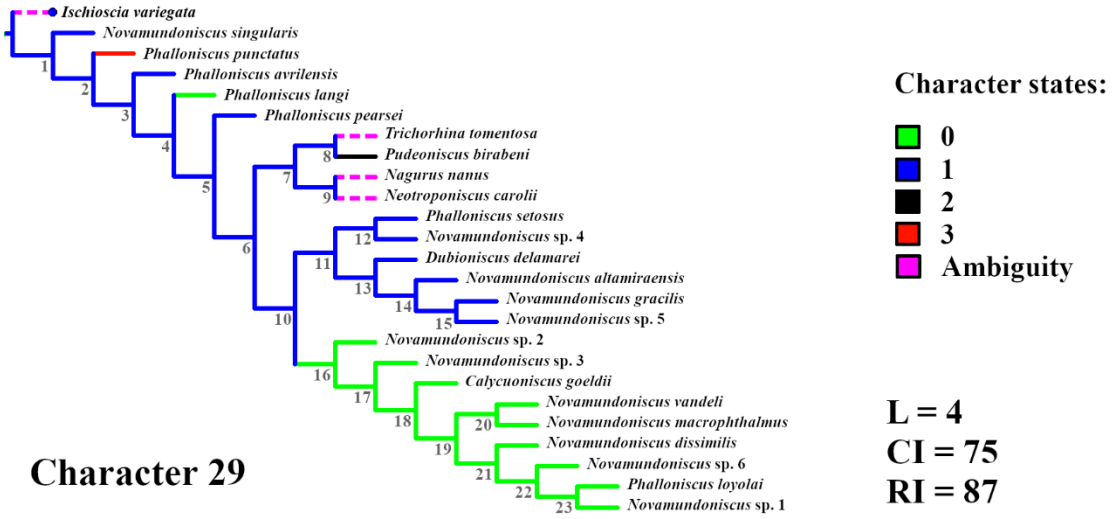


Figure 89. Optimization of character 29 on cladogram. Antenna, flagellum triarticulated, number of asthetascs on second article: (0) 1; (1) 2; (3) a row with a pair plus a single aesthetasc.

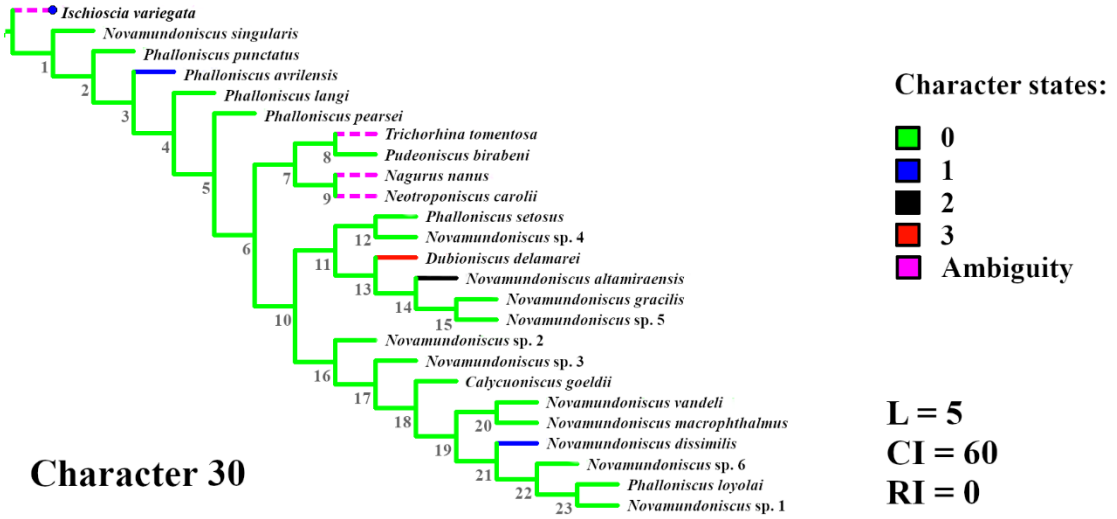


Figure 90. Optimization of character 30 on cladogram. Antenna, flagellum triarticulated, third article, insertion position of asthetascs: (0) medial portion; (1) distal portion; (2) two rows; (3) absent.

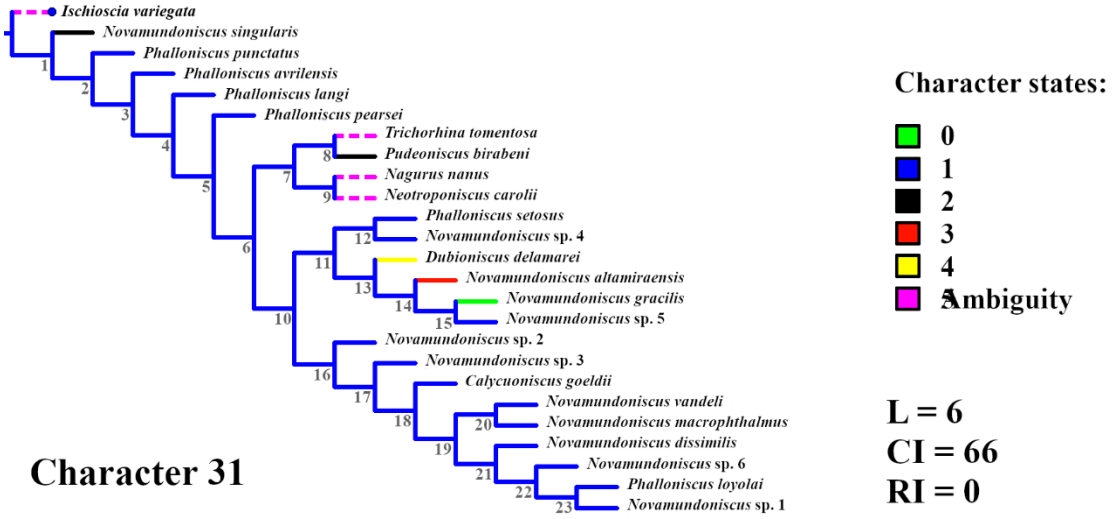


Figure 91. Optimization of character 31 on cladogram. Antenna, flagellum triarticulated, number of asthetascs on third article: (0) 1; (1) 2; (2) 3; (4) absent.

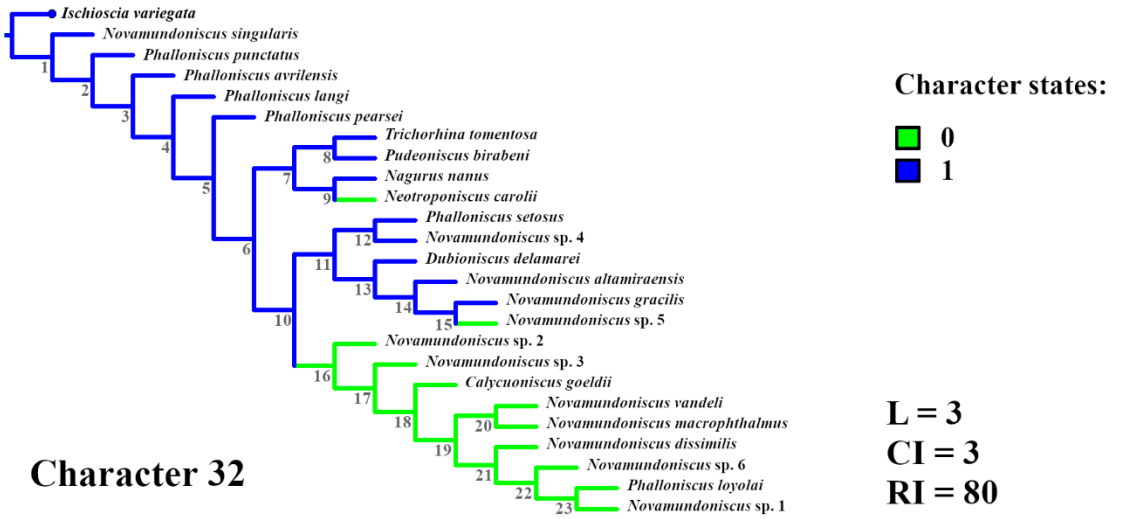


Figure 92. Optimization of character 32 on cladogram. Mandibles, lacinia mobilis basally covered with spines (hairy lobe): (0) not hairy; (1) hairy.

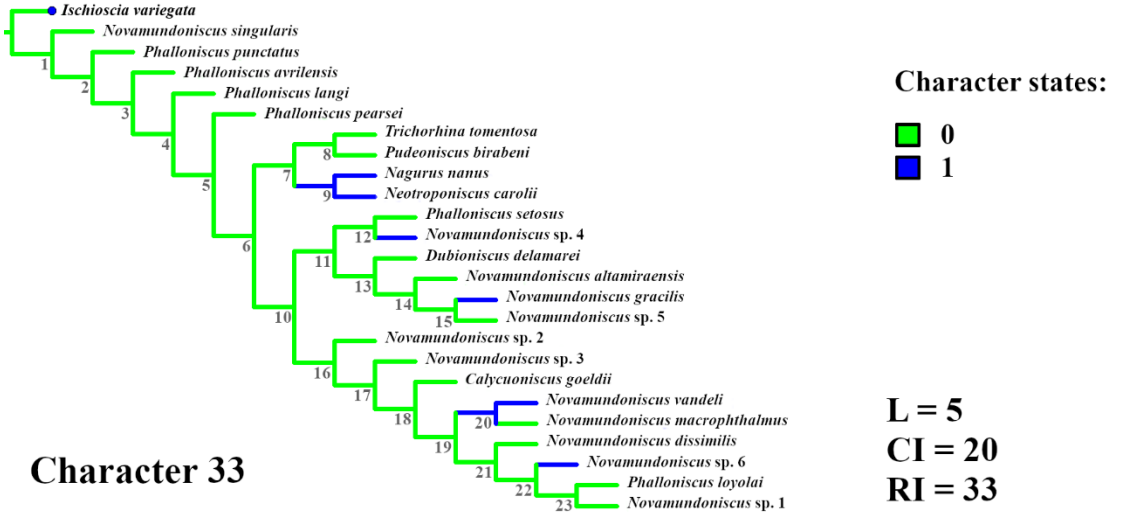


Figure 93. Optimization of character 33 on cladogram. Maxillule, inner branch, apical tip: (0) absent; (1) present.

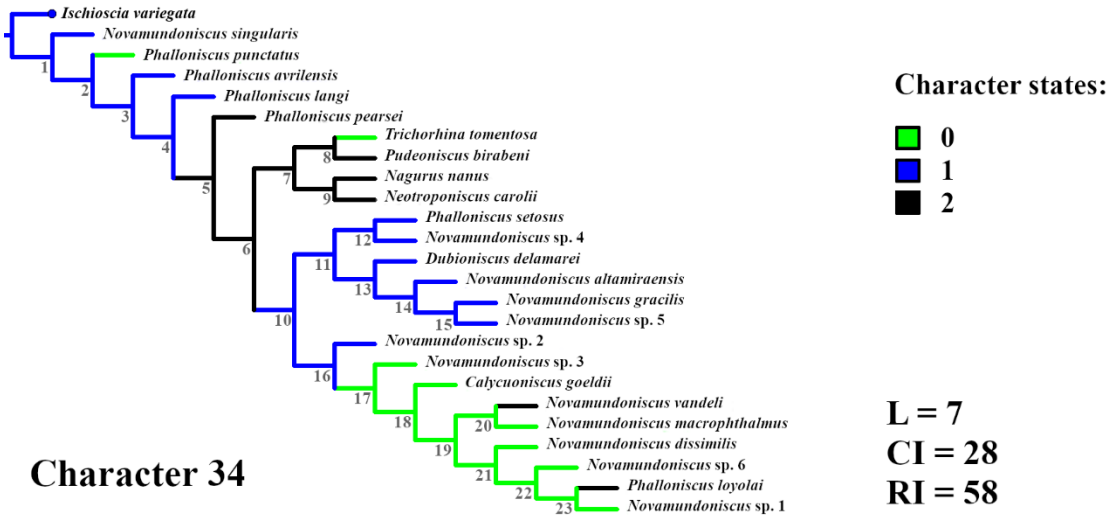


Figure 94. Optimization of character 34 on cladogram. Maxillule, inner endite, laterodistal corner shape: (0) triangular; (1) round; (2) rectangular.


Figure 95. Optimization of character 35 on cladogram. Maxillula, outer branch, set of teeth, composition: (0) 4+4; (1) 4+5; (2) 4+6.

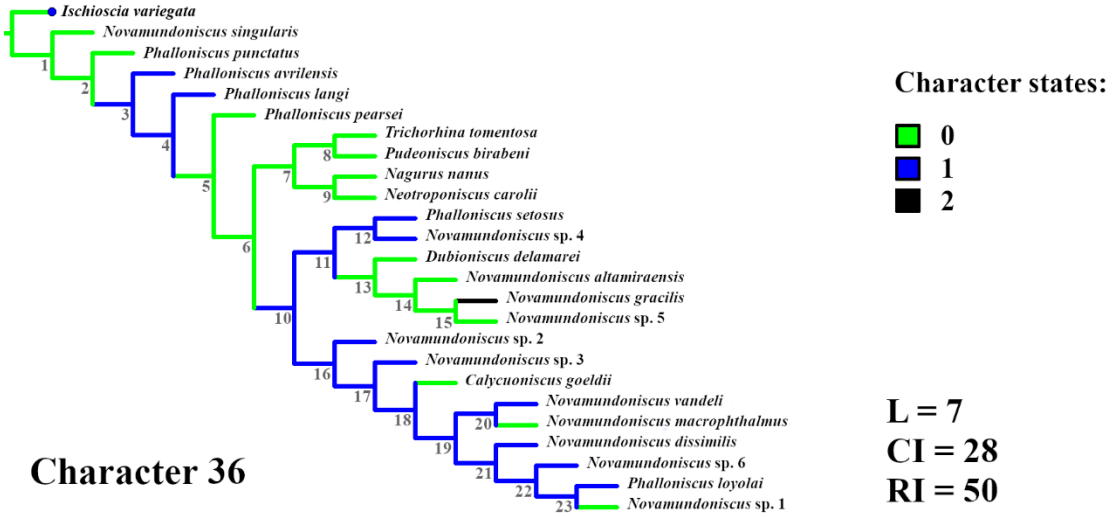


Figure 96. Optimization of character 36 on cladogram. Maxillula, outer endite, outer margin, pilose setae disposition: (0) all over the margin, reaching outer tooth; (1) interrupted in the concavity; (2) not reaching the outer tooth.

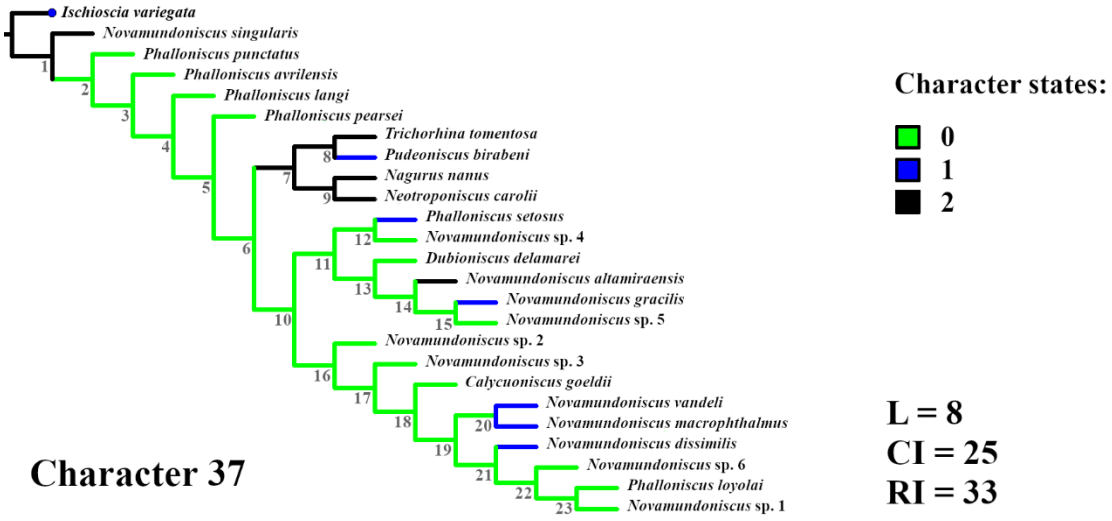


Figure 97. Optimization of character 37 on cladogram. Maxillula, outer branch, inner set of teeth apex: (0) all simple; (1) all cleft; (2) both simple and cleft present.

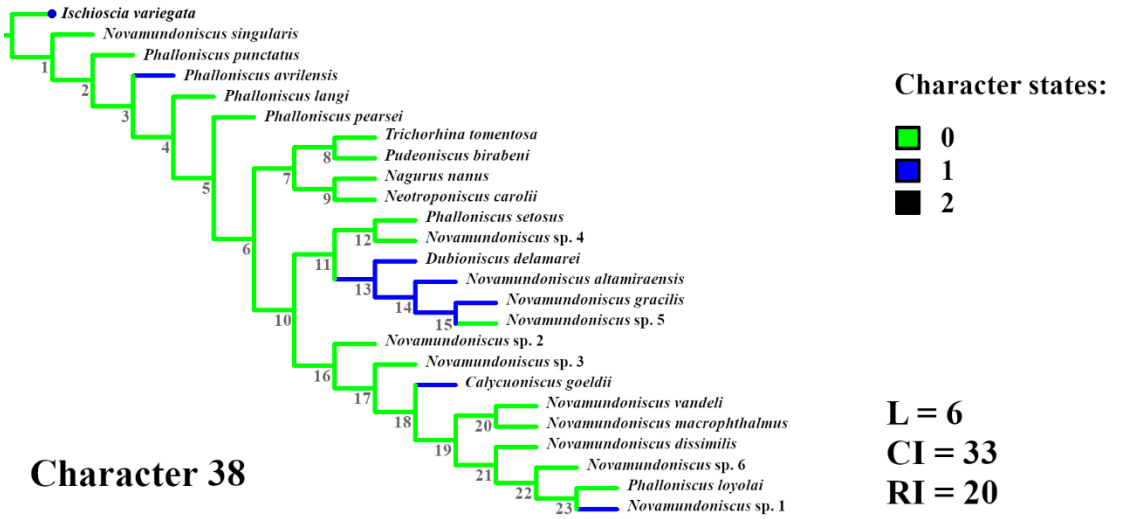


Figure 98. Optimization of character 38 on cladogram. Maxilla, shape: (0) distally round (1) distally truncate.

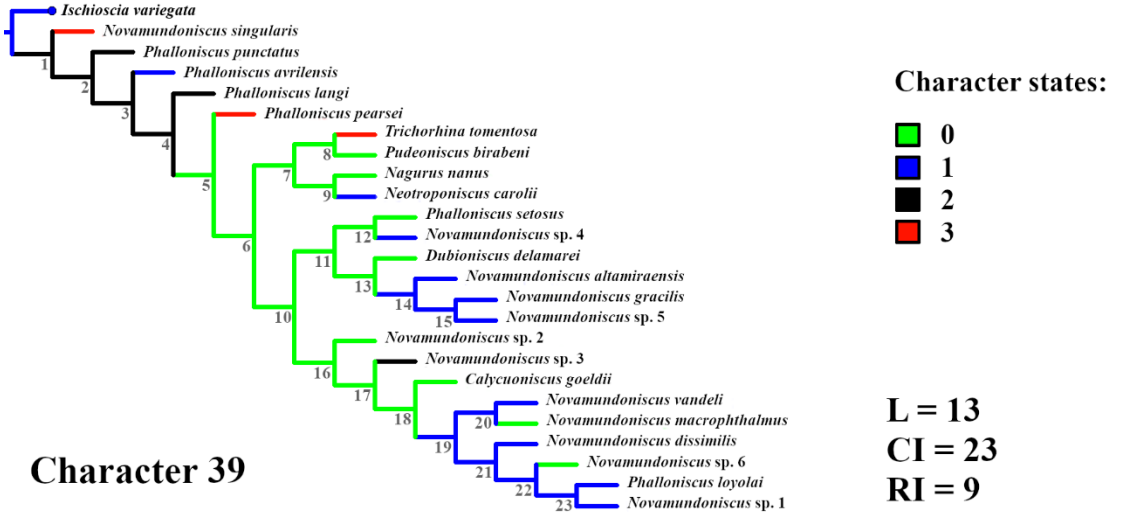


Figure 99. Optimization of character 39 on cladogram. Maxilla, relative width between outer lobe x medial lobe: (0) outer lobe about 3x wider (1) outer lobe about 2x wider; (2) subequal; (3) inner lobe wider than medial lobe.

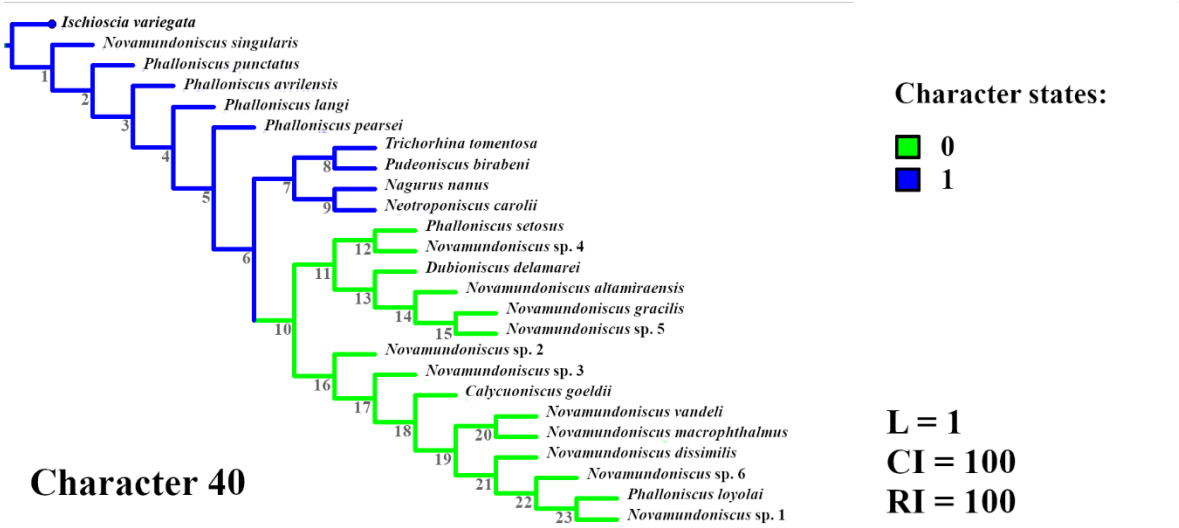


Figure 100. Optimization of character 40 on cladogram. Maxilliped, distal article, set of setae: (0) individual setae; (1) as a tuft.

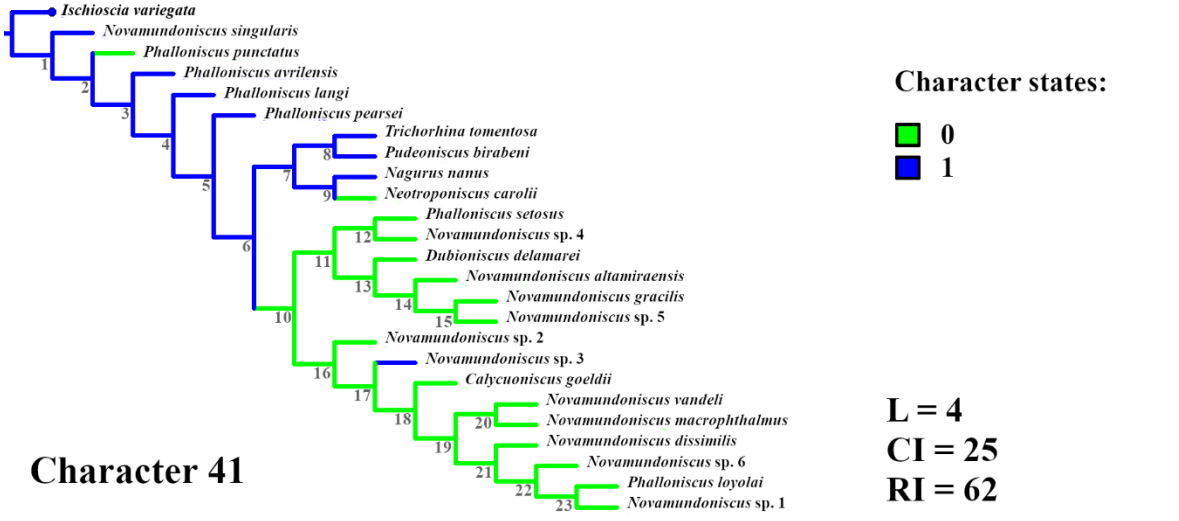


Figure 101. Optimization of character 41 on cladogram. Maxilliped, distal article, set of setae: (0) individual setae; (1) as a tuft.

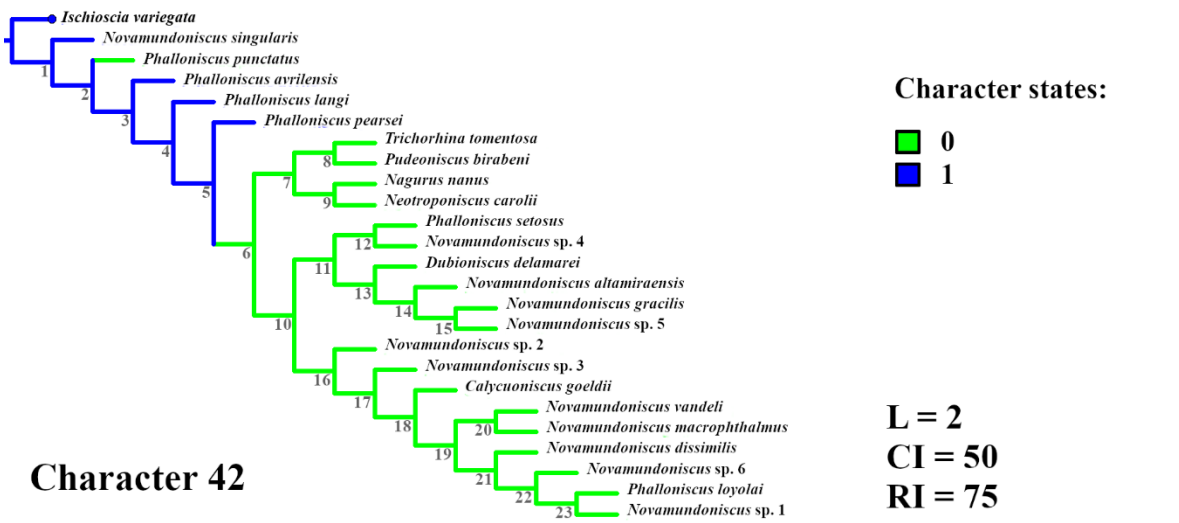


Figure 102. Optimization of character 42 on cladogram. Maxilliped, palp, distal margin shape: (0) rectangular; (1) round.

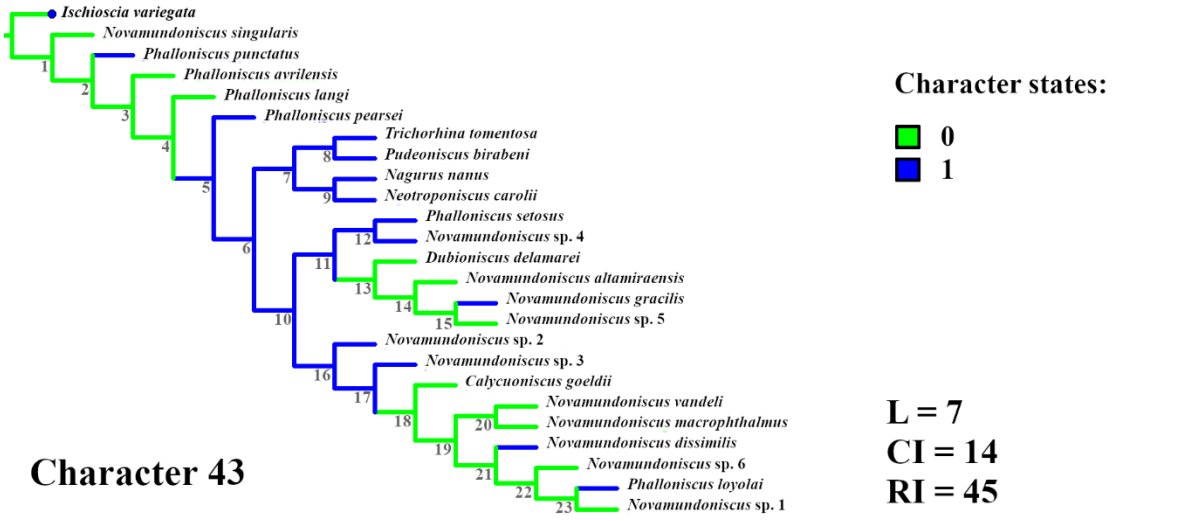


Figure 103. Optimization of character 43 on cladogram. Maxilliped, palp, distal margin: (0) without denticle-like lobes; (1) with denticle-like lobes.

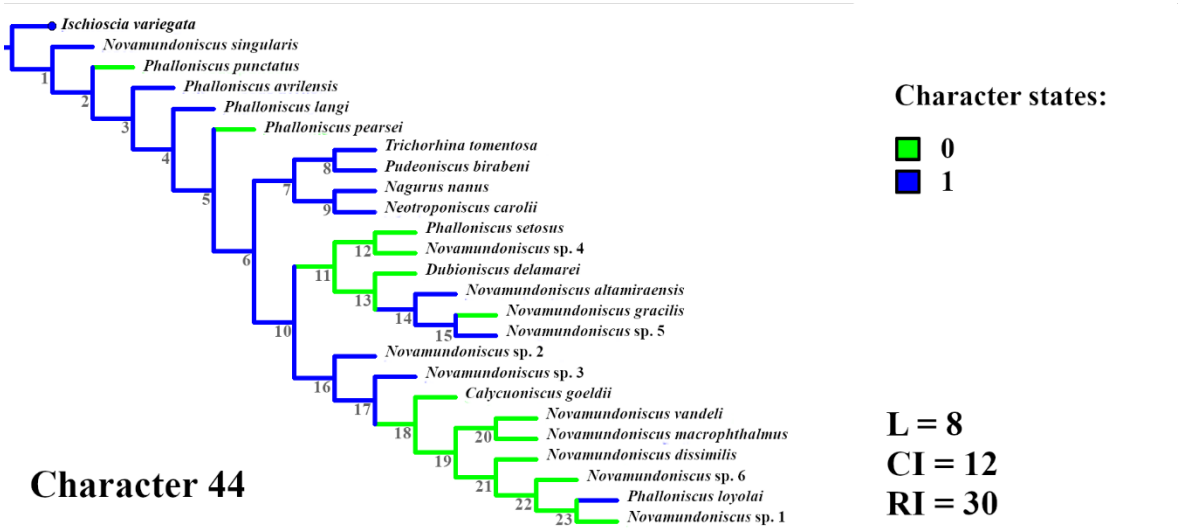


Figure 104. Optimization of character 44 on cladogram. Maxilliped, palp, frontal face: (0) naked; (1) hairy.

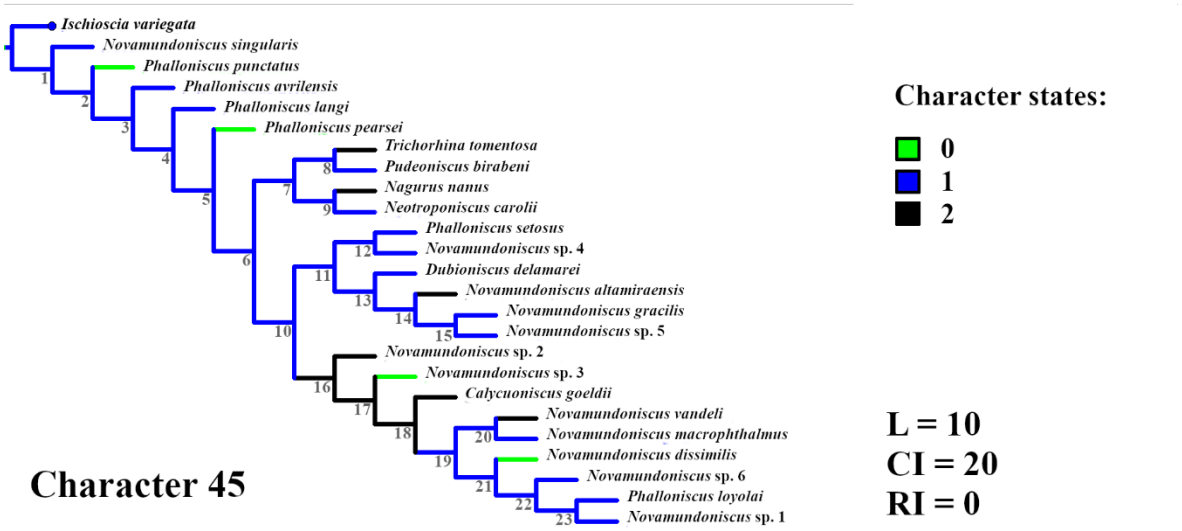


Figure 105. Optimization of character 45 on cladogram. Pereopods 1-7, dactylus, inner claw length related to outer claw: (0) Inner claw vestigial; (1) inner claw shorter than outer claw (2) inner claw subqual or as long as outer claw, more than 75% the length of outer claw.

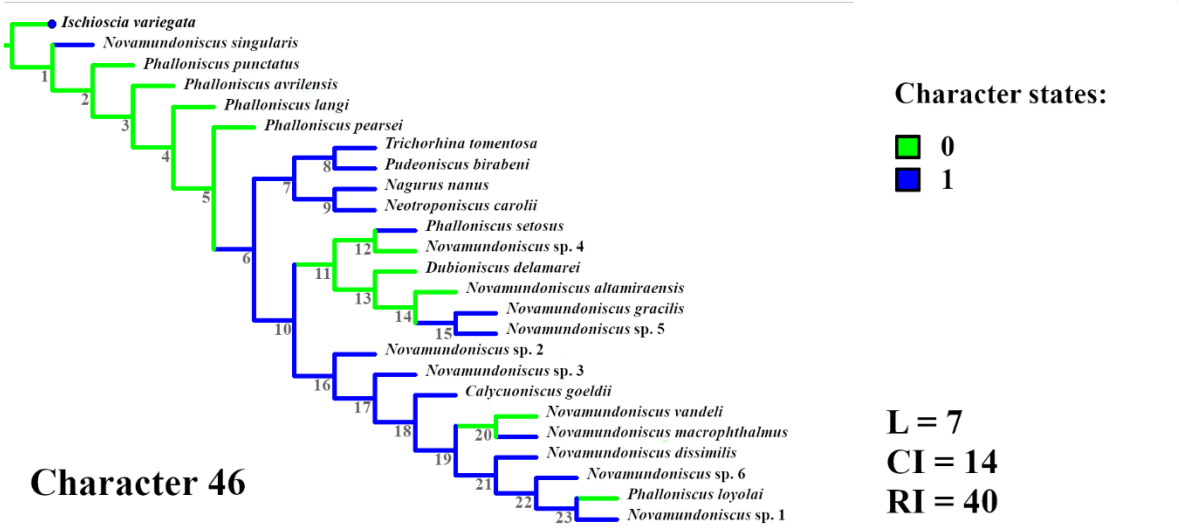


Figure 106. Optimization of character 46 on cladogram. Pereopods 1-7, dactylus, dactylar seta length related to outer claw: (0) dactylar seta shorter than outer claw; (1) dactylar seta as long as or longer than outer claw.

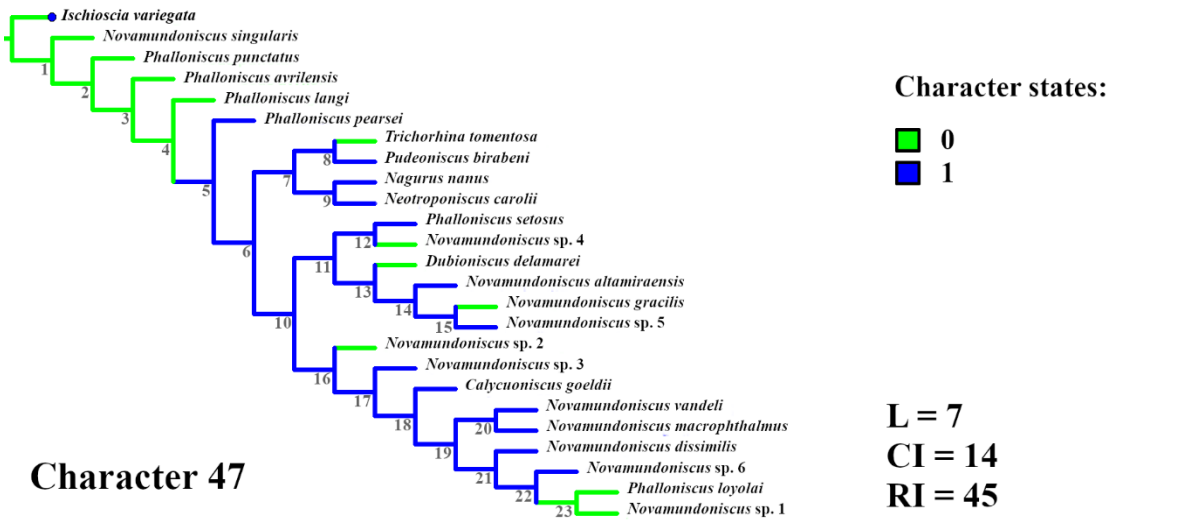


Figure 107. Optimization of character 47 on cladogram. Pereopods 1-7, dactylus, ungual seta length related to outer claw: (0) ungual seta shorter than outer claw; (1) ungual seta as long as or longer than outer claw.

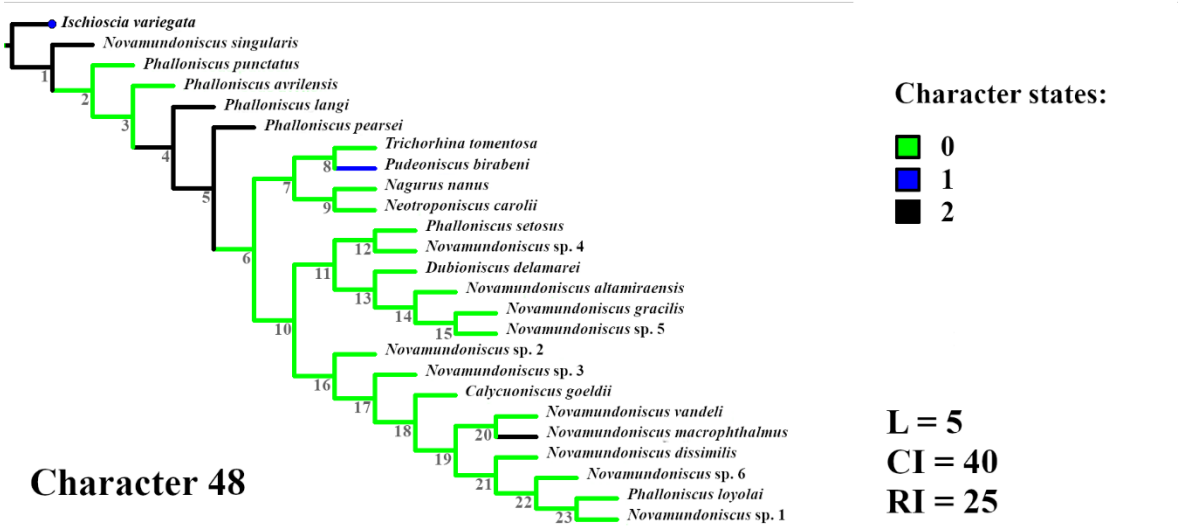


Figure 108. Optimization of character 48 on cladogram. Pereopods 1-7, dactylus, dactylar seta, shape of tip: (0) simple; (1) enlarged on tip; (2) apically fringed with setules.

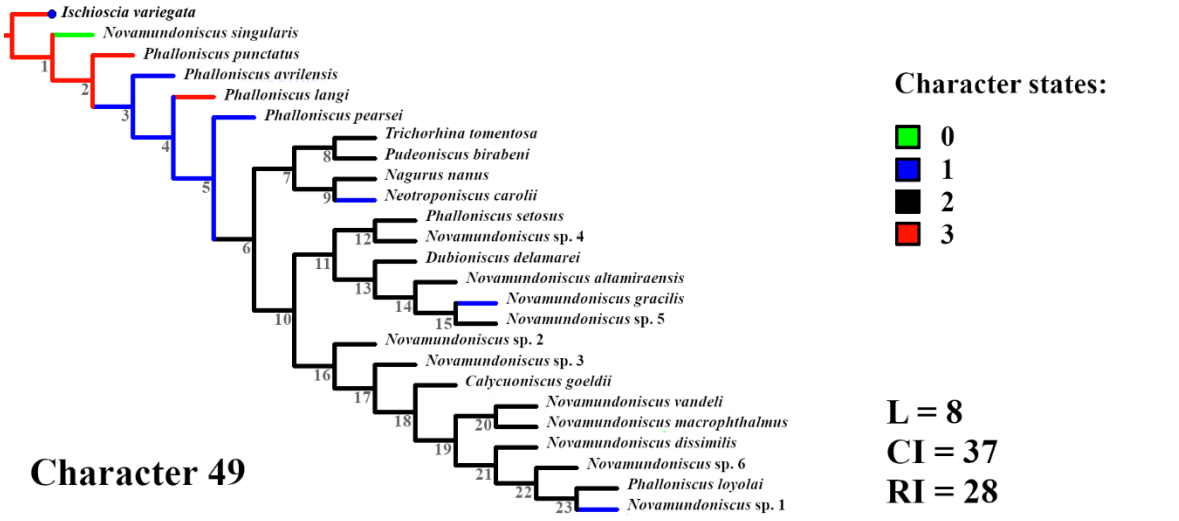


Figure 109. Optimization of character 49 on cladogram. Pereopod 1, Carpus, antennal brush, proportion in length related to carpus length: (0) extremely reduced (less than 20%); (1) about 1/3; (2) about half the length; (3) about ¾ or more.

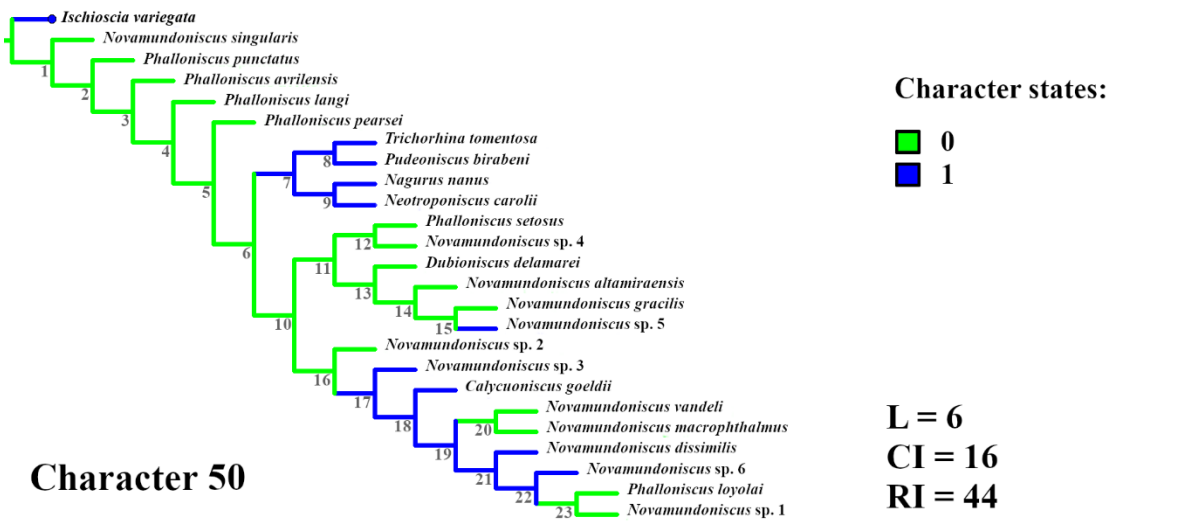


Figure 110. Optimization of character 50 on cladogram. Pereopod 1, carpus, width in relation to length (%): (0) up to 50%; (1) more than 50%.

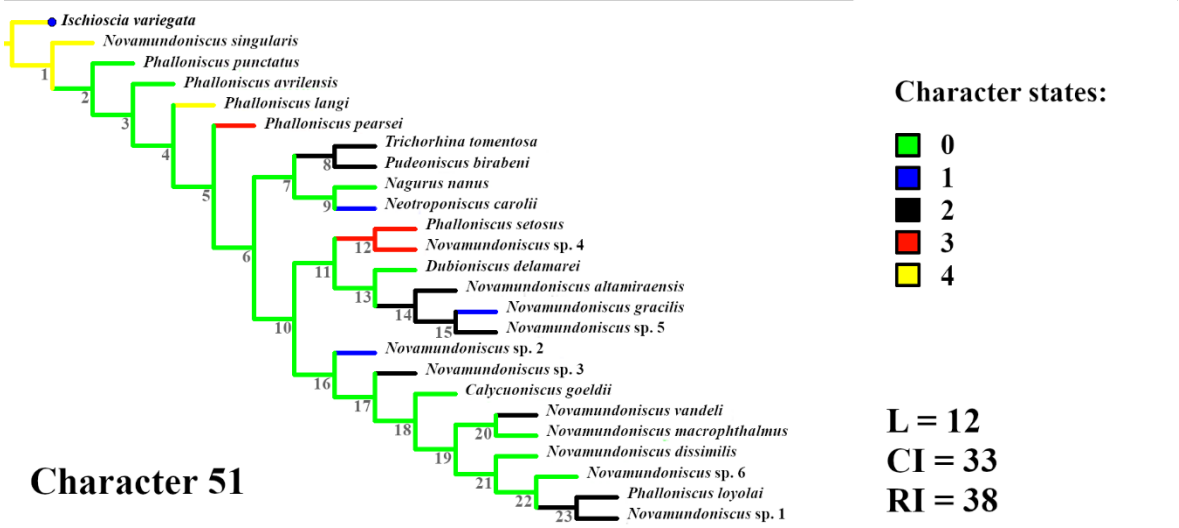


Figure 111. Optimization of character 51 on cladogram. Pereopod 1, Carpus, sensorial seta apex shape: (0) double-fringe (2-1-2); (1) triple-fringe (3-1-3); (2) multiple-fringe; (3) with fringes and double apex; (4) with fringes and globose apex.

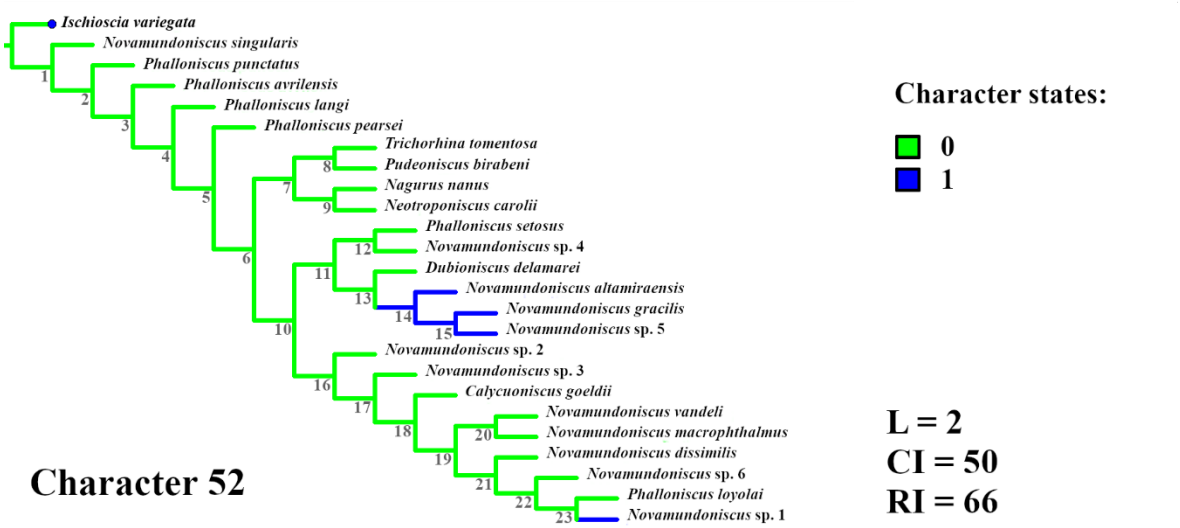


Figure 112. Optimization of character 52 on cladogram. Pereopod 7, ischium, fringe of long setae on dorsal margin: (0) absent; (1) present.

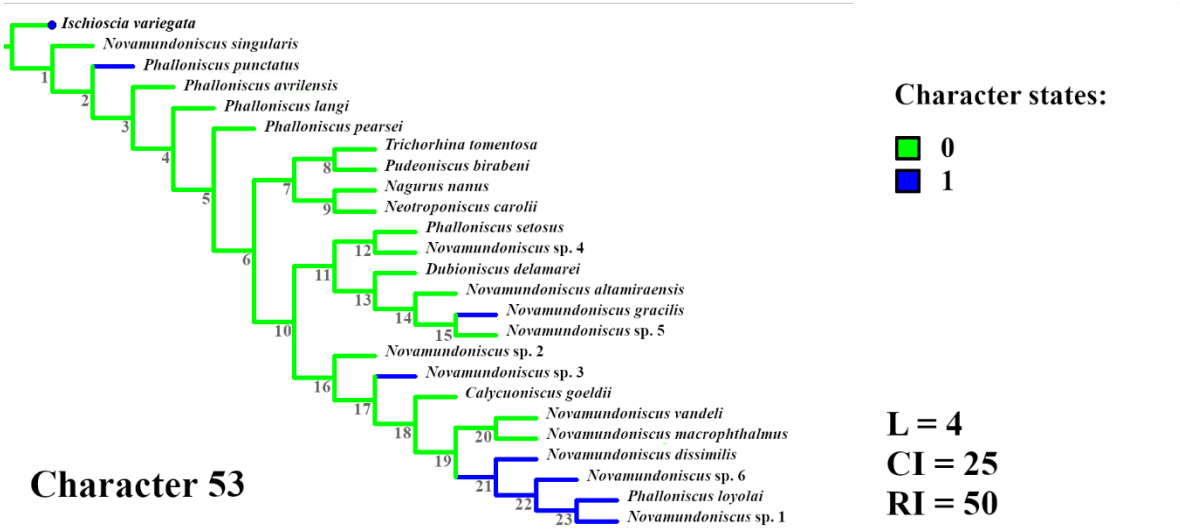


Figure 113. Optimization of character 53 on cladogram. Genital papilla ventral shield, width x length relation: (0) about 3 times longer than larger; (1) about 2 times longer than larger.

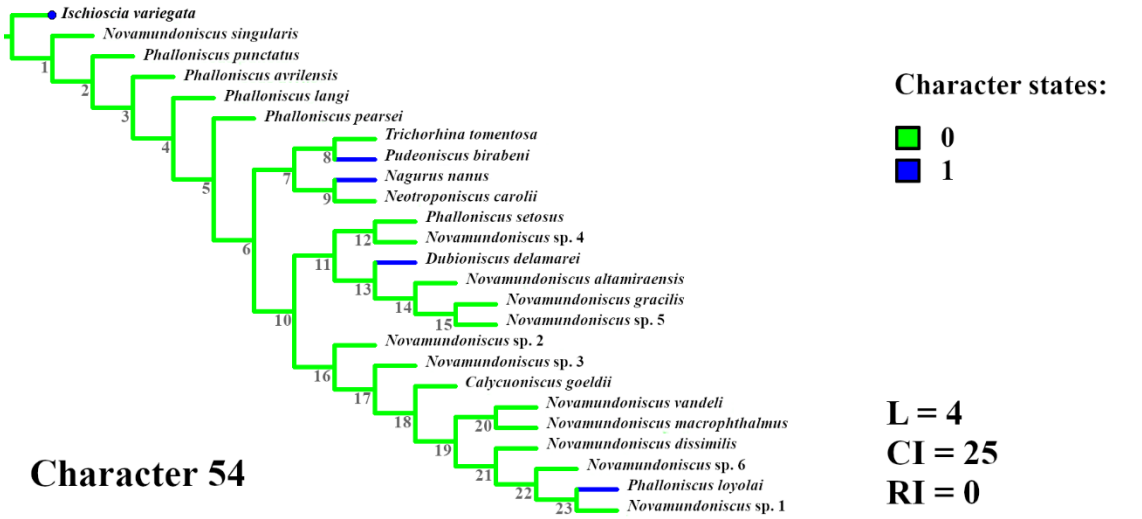


Figure 114. Optimization of character 54 on cladogram. Pleopod exopod, respiratory fields: (0) absent; (1) present.

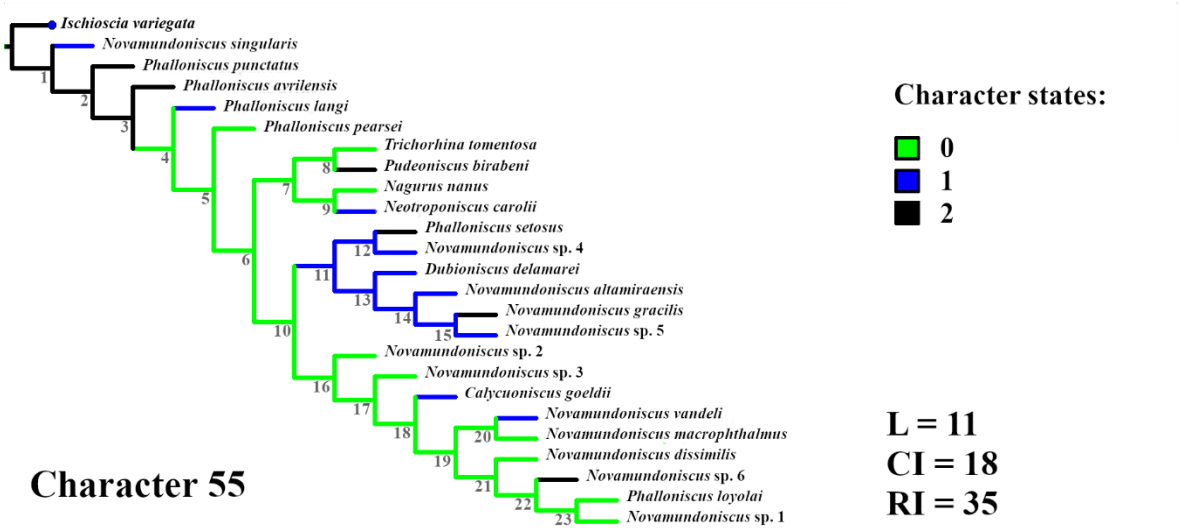


Figure 115. Optimization of character 55 on cladogram. Pleopod 1 exopod (males), shape: (0) round, elipzoidal or ovoid; (1) rectangular; (2) triangular.

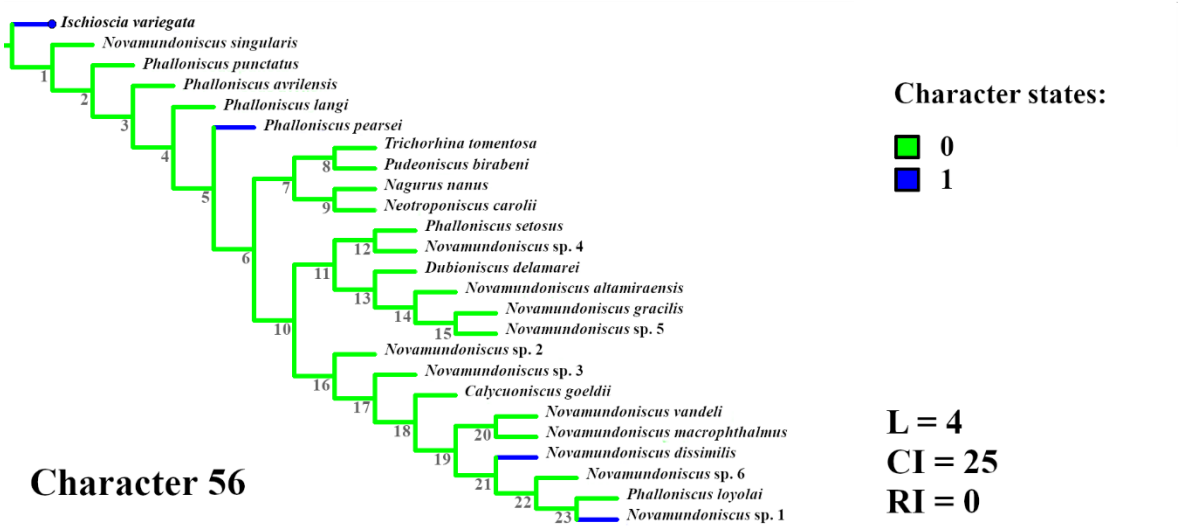


Figure 116. Optimization of character 56 on cladogram. Pleopod 1 exopod (males), presence of lobe: (0) absent; (1) present.

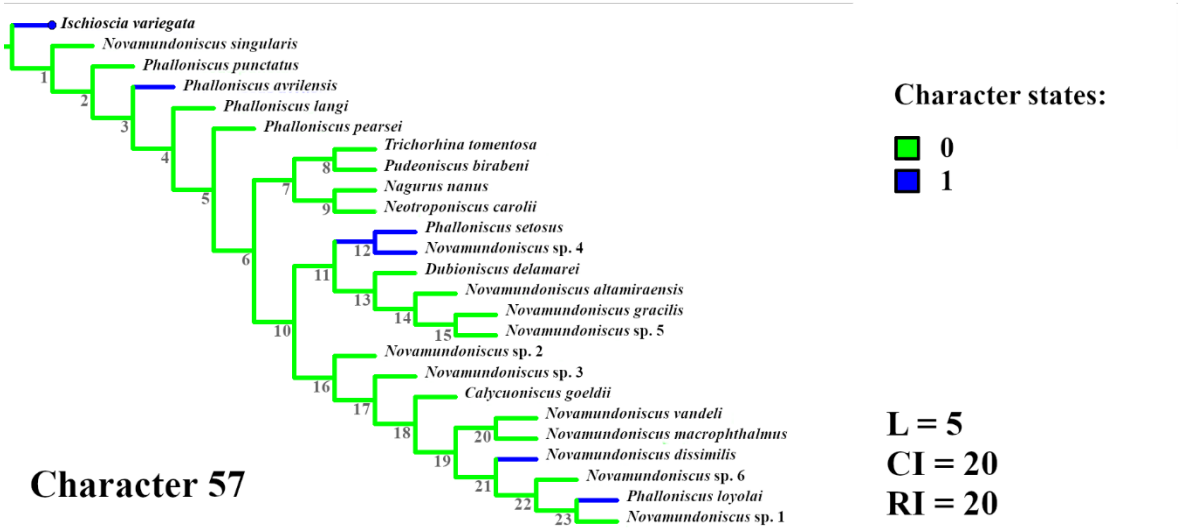


Figure 117. Optimization of character 57 on cladogram. Pleopod 1 endopod (males), distal portion, presence of setae minute: (0) absent; (1) present.

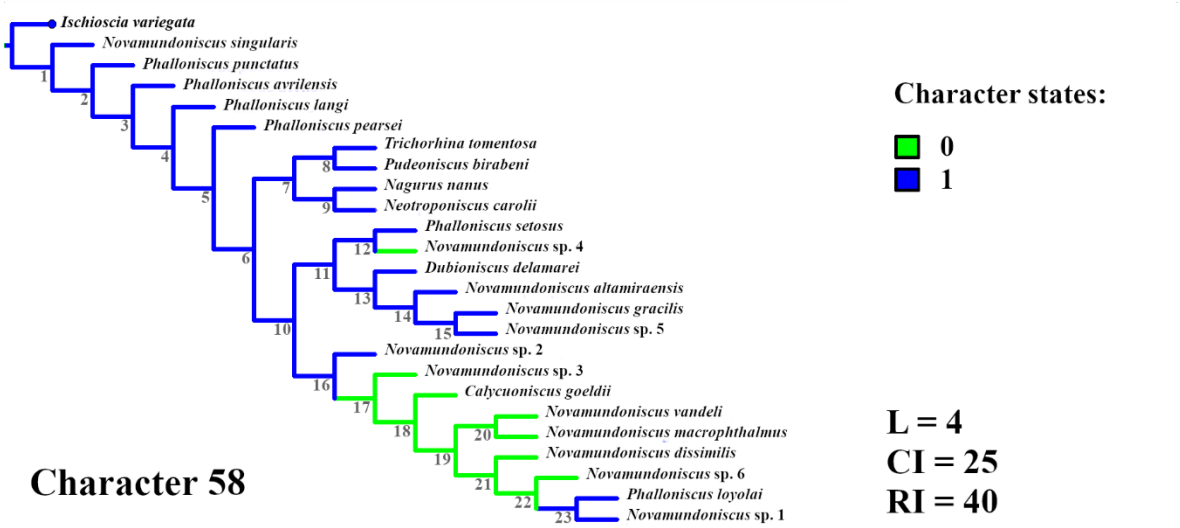


Figure 118. Optimization of character 58 on cladogram. Pleopod 1 endopod (males), width x length relation: (0) about 2x longer than wide; (1) about 3 or more times longer than wide.

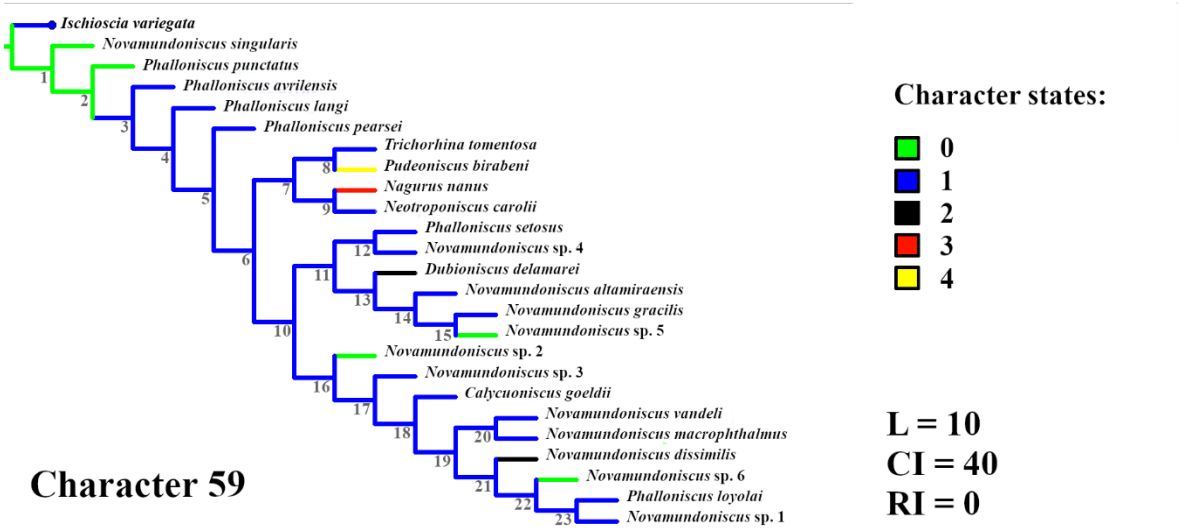


Figure 119. Optimization of character 59 on cladogram. Pleopod 1 endopod (males), proximal portion length related to pleopod total length (approx.): (0) 30%; (1) 35%; (2) 40%; (3) 45%; (4) 50%.

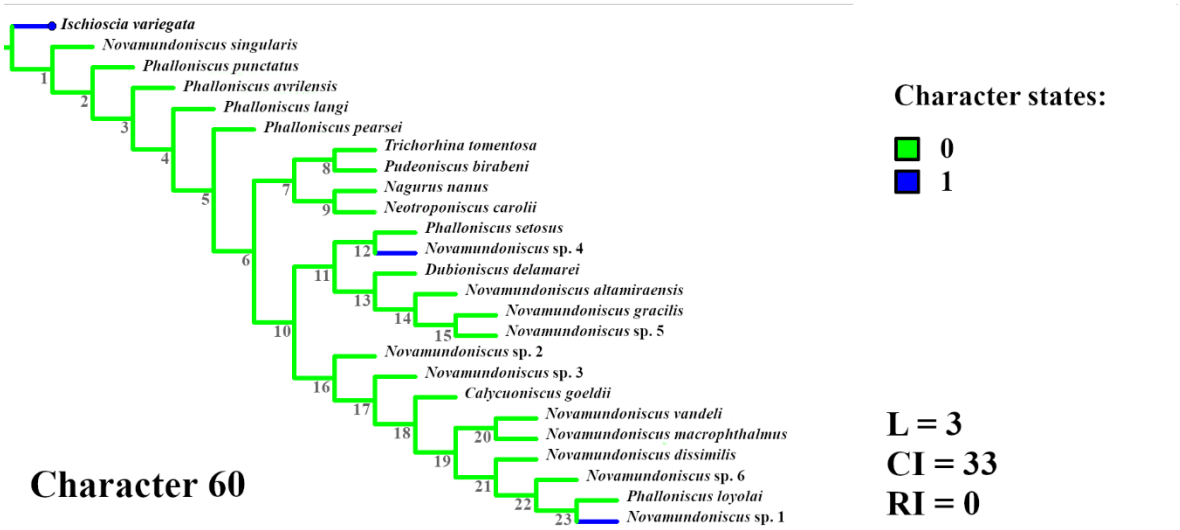


Figure 120. Optimization of character 60 on cladogram. Pleopod 1 endopod (males), distal portion, apex orientation (0) outwards; (1) downwards.

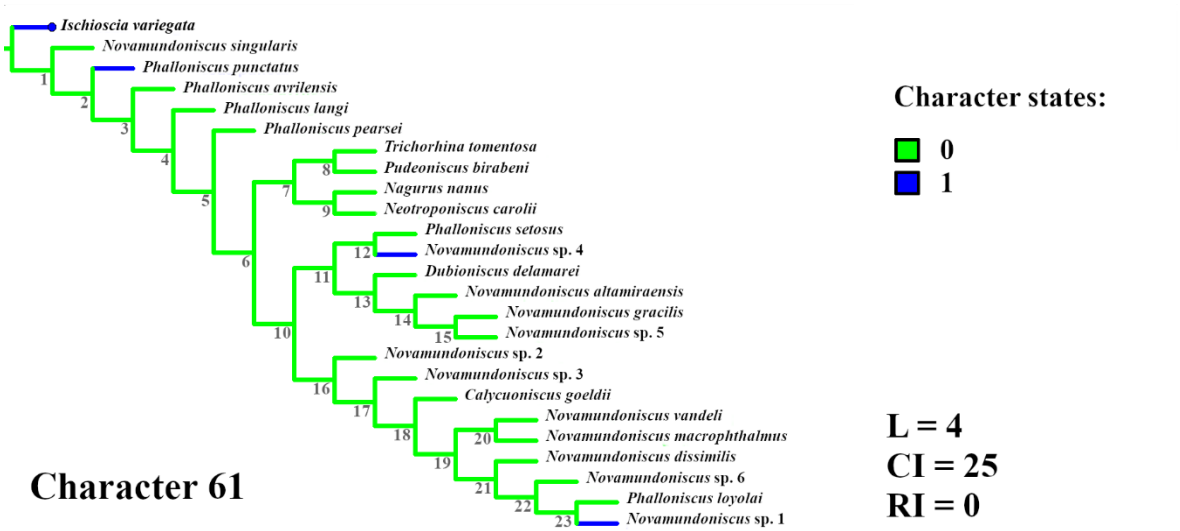


Figure 121. Optimization of character 61 on cladogram. Pleopod 2 exopod (males), width x length relation: (0) up to 50% longer than larger; (1) more than 50% longer than larger.

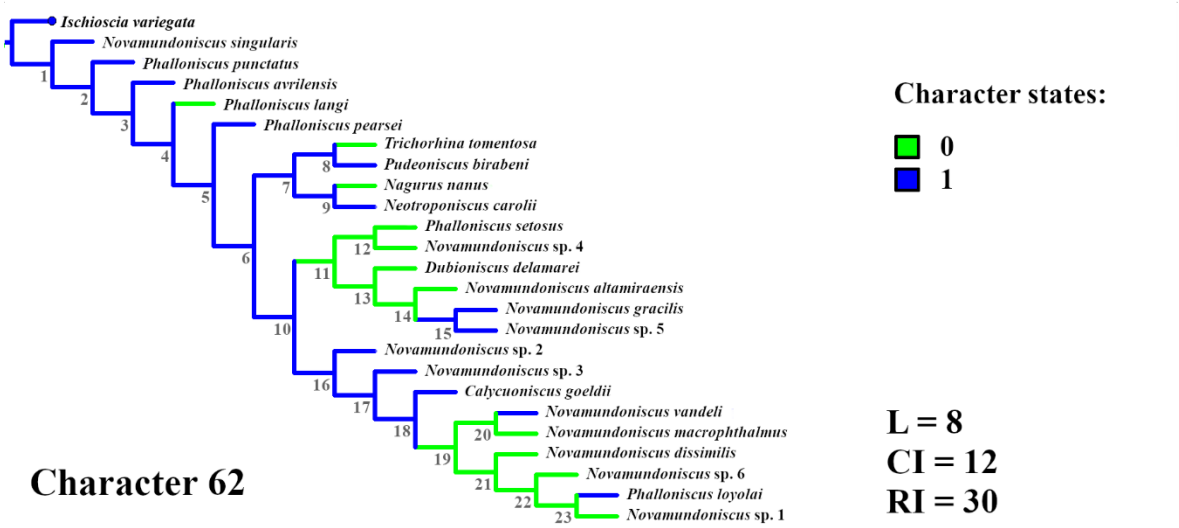


Figure 122. Optimization of character 62 on cladogram. Pleopod 2 exopod (males), extremity, shape: (0) lanceolate; (1) round.

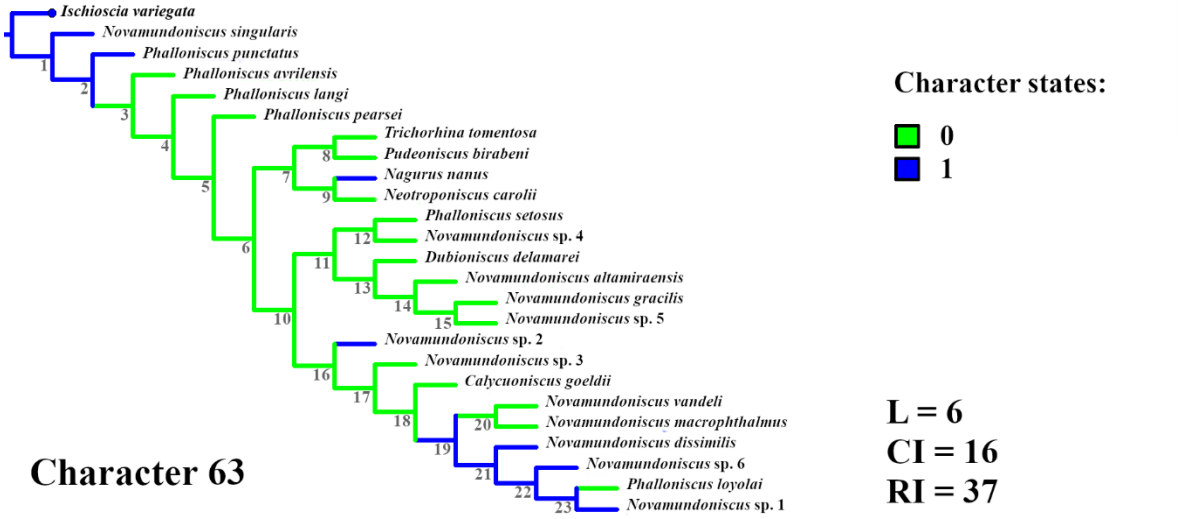


Figure 123. Optimization of character 63 on cladogram. Pleopod 2 endopod (males), length relative to the exopod: (0) longer than exopod; (1) subequal.

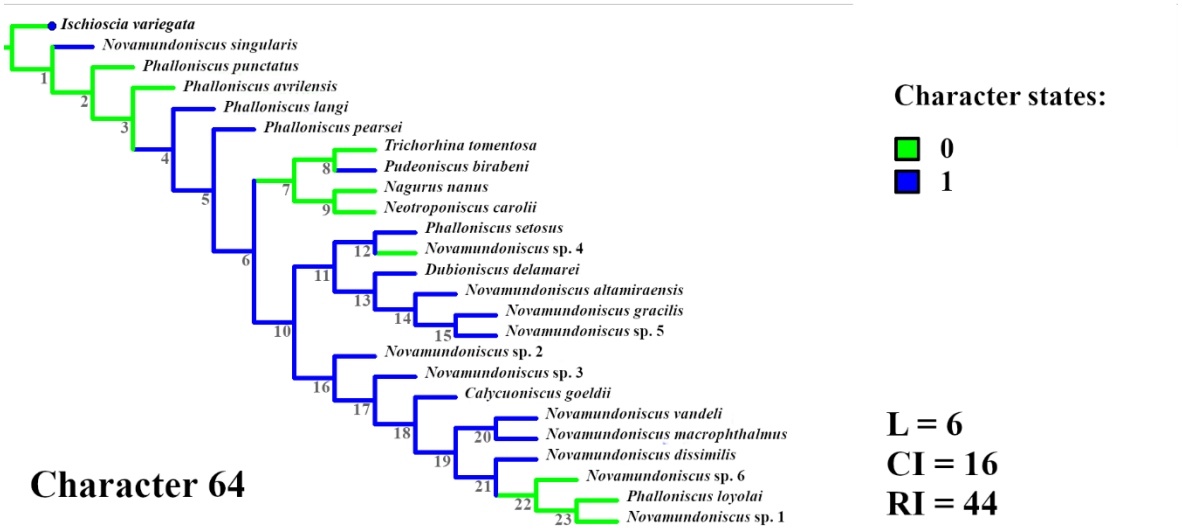


Figure 124. Optimization of character 64 on cladogram. Pleopod 2 endopod (males), length relative to the exopod: (0) longer than exopod; (1) subequal.

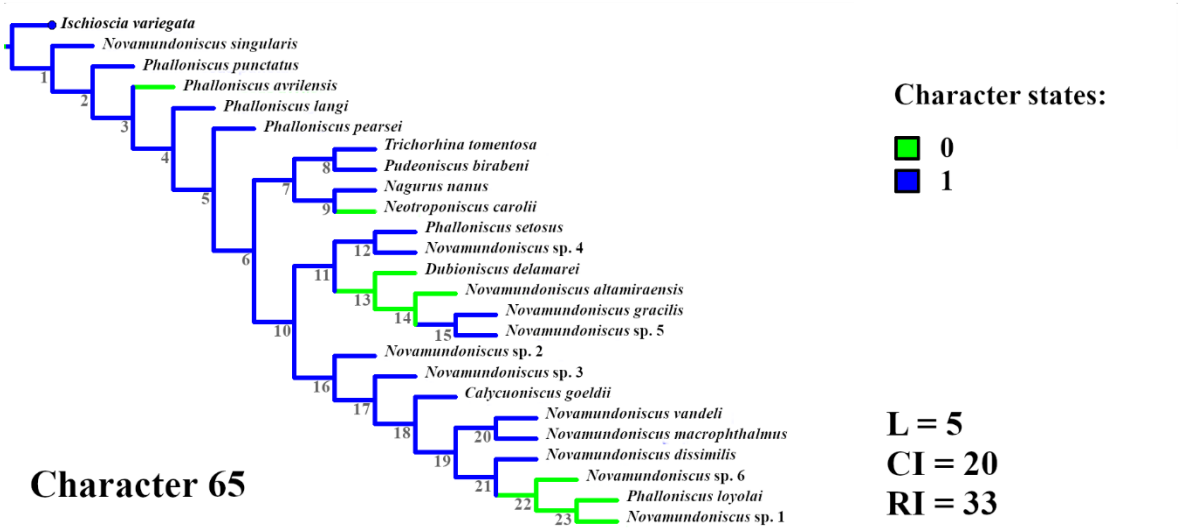


Figure 125. Optimization of character 65 on cladogram. Pleopod 3 exopod (male), shape related to pleopods 2 and 4: (0) pleopod 3 like; (1) pleopod 4 like.

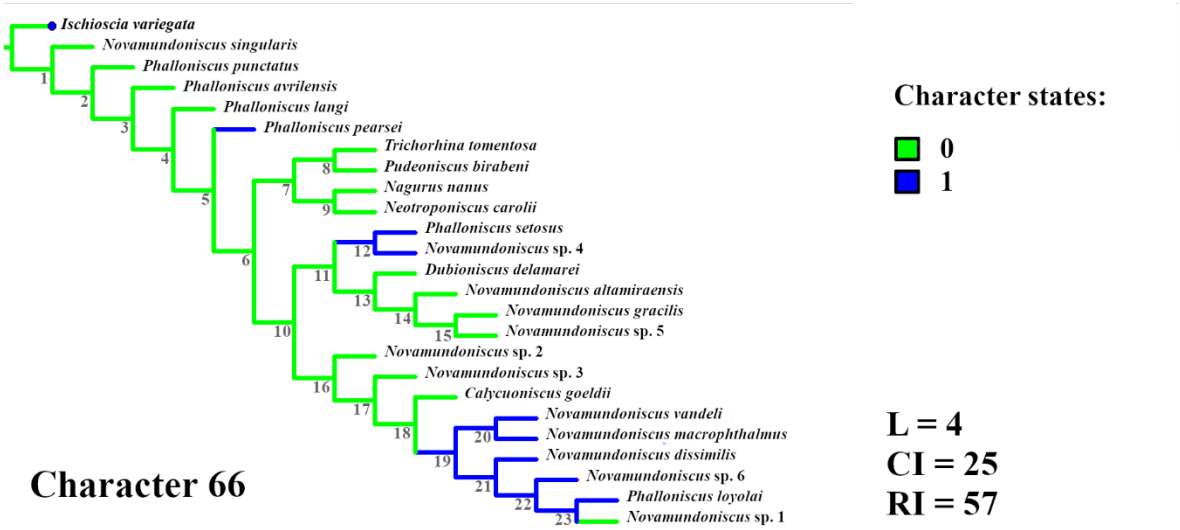


Figure 126. Optimization of character 66 on cladogram. Pleopod 3 exopod (male), fringe of minute setae on distal portion: (0) absent; (1) present.

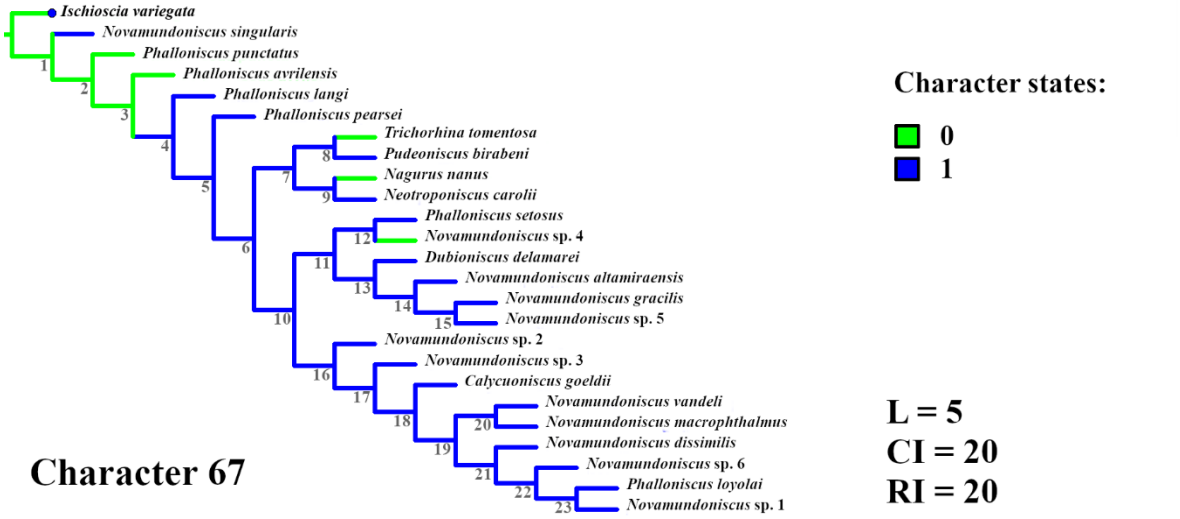


Figure 127. Optimization of character 67 on cladogram. Pleopod 4 exopod (male), shape: (0) triangular; (1) rectangular.

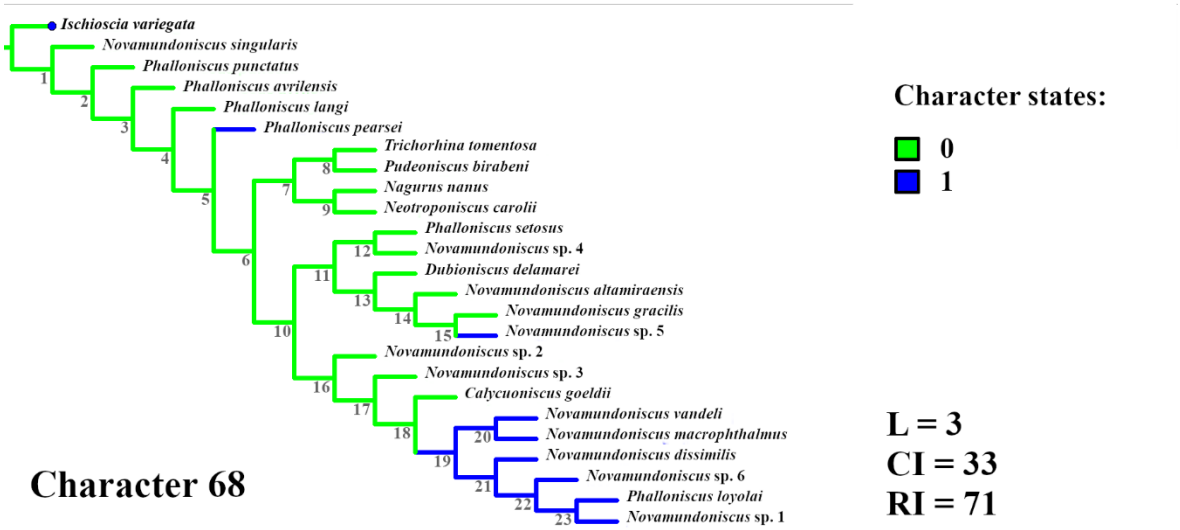


Figure 128. Optimization of character 68 on cladogram. Pleopod 4 exopod (male), fringe of minute setae on distal portion: (0) absent; (1) present.

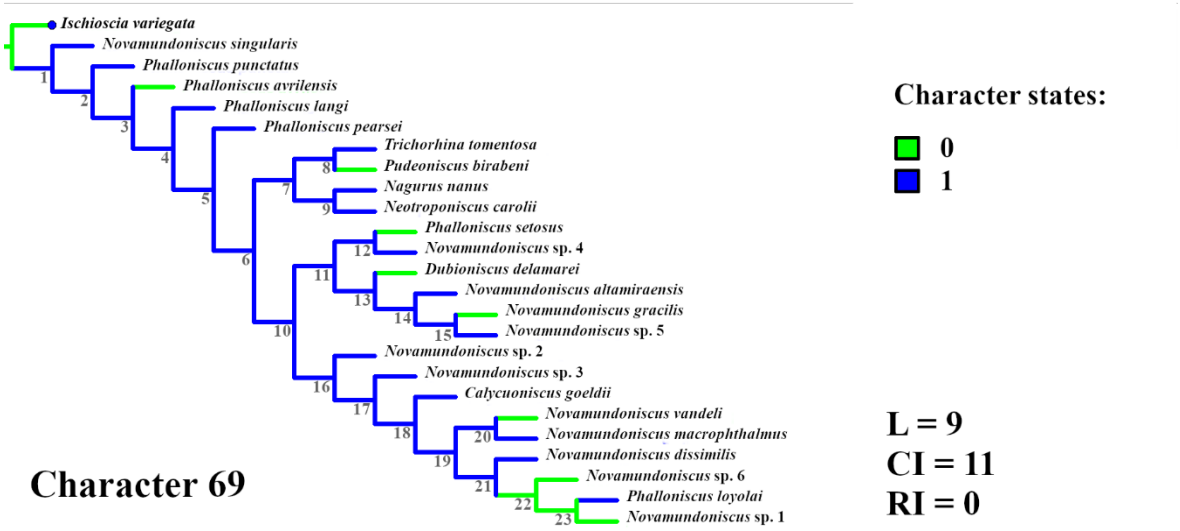


Figure 129. Optimization of character 69 on cladogram. Pleopod 4 exopod (male), outer margin, shape: (0) concave; (1) straight.

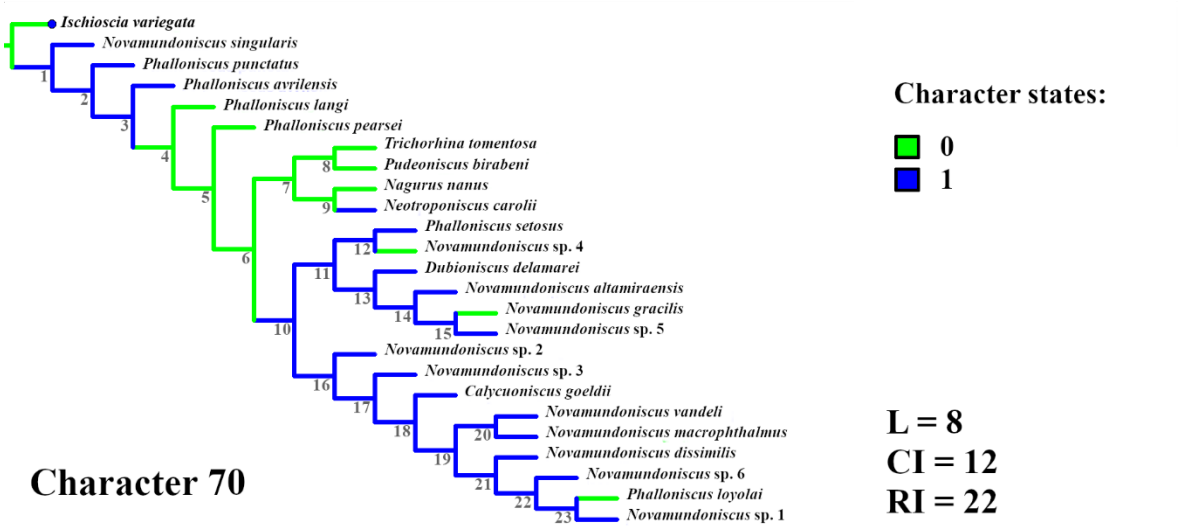


Figure 130. Optimization of character 70 on cladogram. Pleopod 5 exopod (male), shape: (0) triangular; (1) subrectangular or trapezoidal.

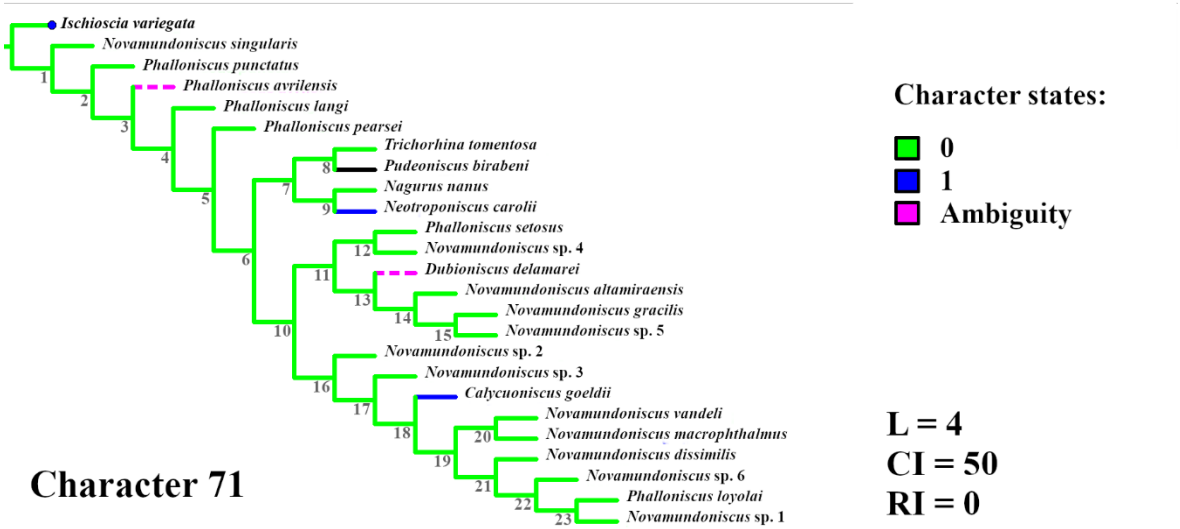


Figure 131. Optimization of character 71 on cladogram. Pleopod 5 exopod (male), shape: (0) triangular; (1) subrectangular or trapezoidal.

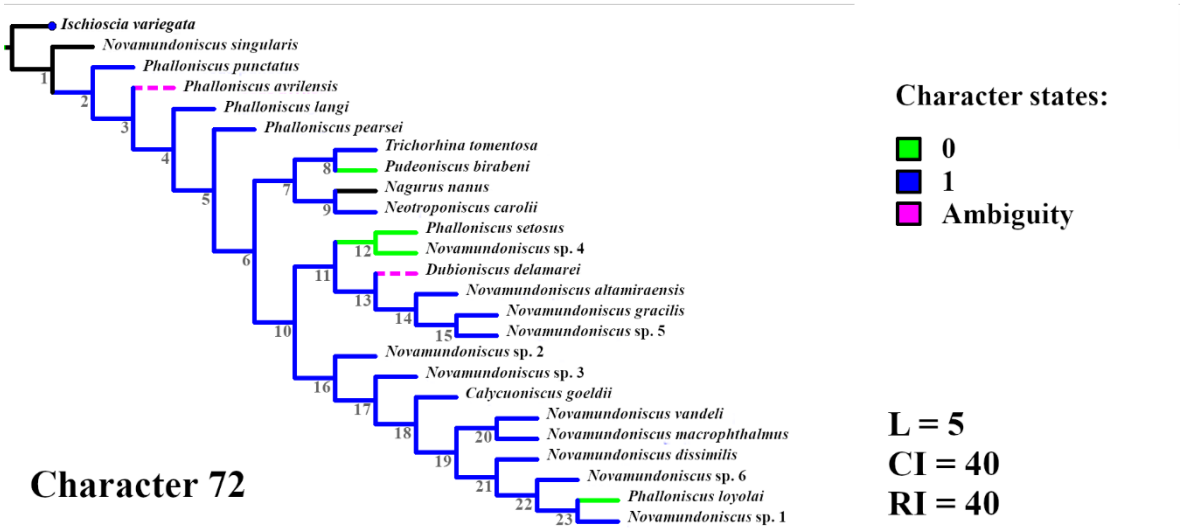


Figure 132. Optimization of character 72 on cladogram. Uropod, exopod, dimensions: (0) about 2x longer than wide; (1) about 2,5 x longer than wide; (2) about 3x or longer.

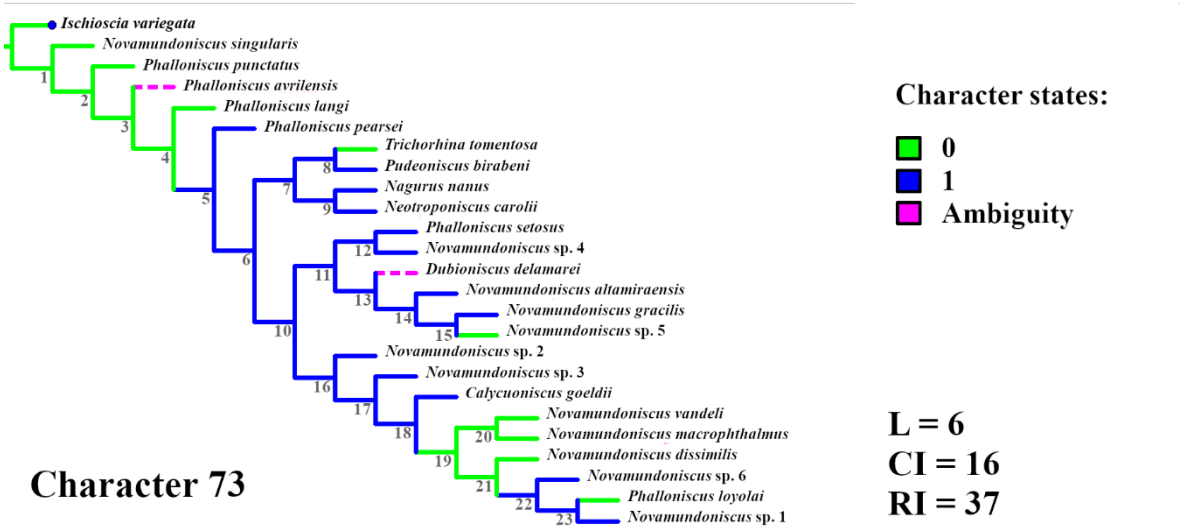


Figure 133. Optimization of character 73 on cladogram. Inner margin of uropod endopod, longitudinal row of long setae: (0) absent; (1) present.