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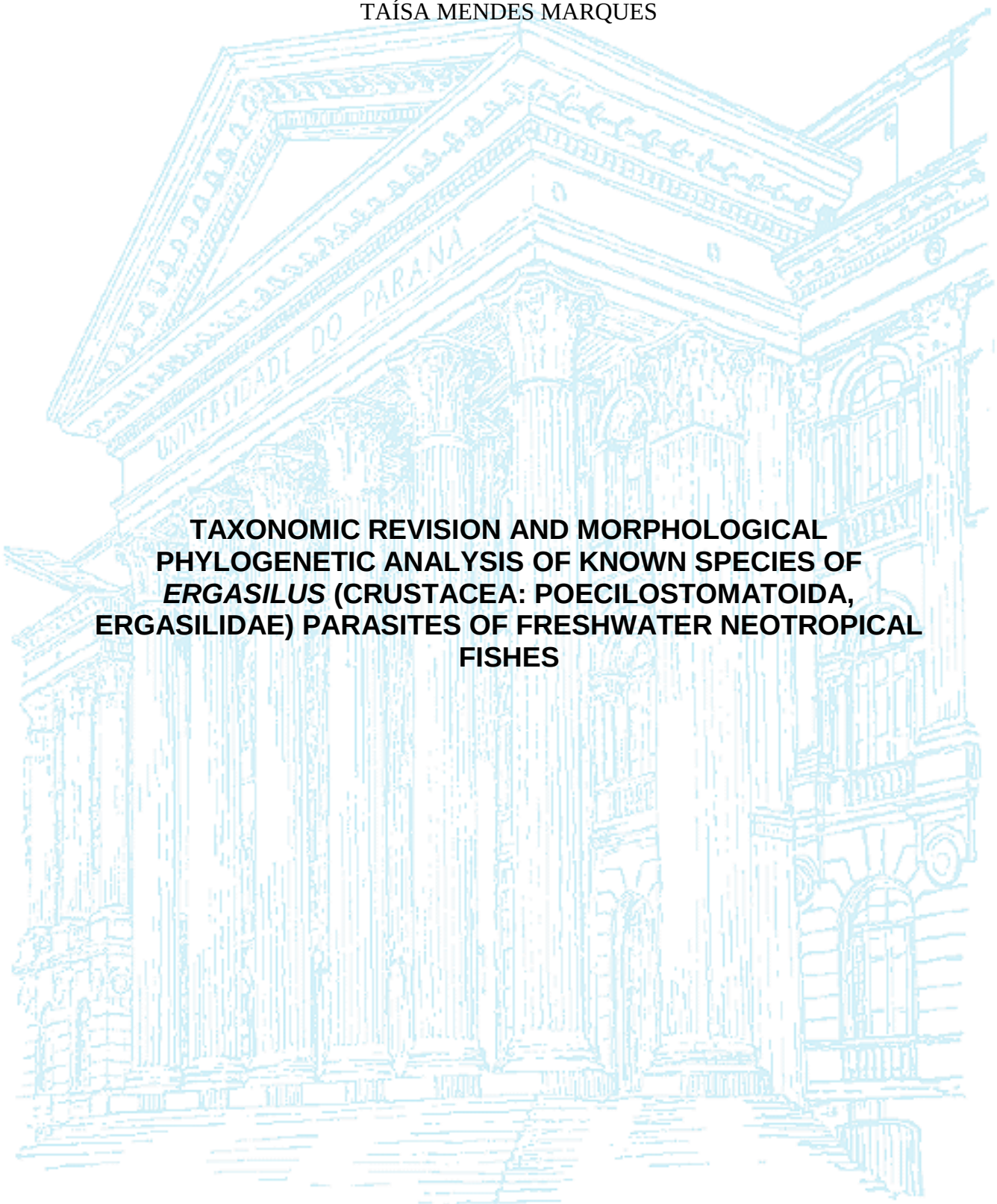

TAXONOMIC REVISION AND MORPHOLOGICAL PHYLOGENETIC ANALYSIS OF KNOWN SPECIES OF *ERGASILUS* (CRUSTACEA: POECILOSTOMATOIDA, ERGASILIDAE) PARASITES OF FRESHWATER NEOTROPICAL FISHES

CURITIBA, 2014

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Dissertação apresentada ao Programa de Pós-Graduaçãoem Ciências Biológicas - Microbiologia, Parasitologia e Patologia, Setor de Ciências Biológicas da Universidade Federal do Paraná, como requisito parcial à obtenção do título de Mestre em Ciências Biológicas área de concentração Parasitologia.

Orientador: Walter A. Boeger, Ph.D.

CURITIBA, 2014

Ministério da Educação
UNIVERSIDADE FEDERAL DO PARANÁ
SETOR DE CIÊNCIAS BIOLÓGICAS
Departamento de Patologia Básica
Pós-graduação em Microbiologia, Parasitologia e Patologia.

TERMO DE APROVAÇÃO

"Taxonomic Revision and Morphological Phylogenetic Analysis of Known Species of Ergasilus (Poecilostomatoida, Ergasilidae) parasites of freshwater neotropical fishes".

Por

TAÍSA MENDES MARQUES

Tese aprovada como requisito parcial para obtenção do grau de Mestre no Curso de Pós-Graduação em Microbiologia, Parasitologia e Patologia, pela Comissão formada pelos professores:

Prof. Dr. Walter Antonio Pereira Boeger (presidente)

Profª. Drª. Luciane Marinoni

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Curitiba, 24 de março de 2014.

Agradecimentos

Em primeiro lugar, agradeço a Deus, não só nesta etapa, mas em toda minha vida.

Agradeço, especialmente, meu orientador, Dr. Walter Boeger, pesquisador exemplar, que acreditou em mim. Obrigada pela oportunidade e confiança, por estar sempre disposto e paciente para tirar minhas dúvidas, pela ajuda significativa que contribuiu para meu desenvolvimento acadêmico e para realização deste projeto. É com muita admiração e respeito que demonstro meu sincero agradecimento.

Gostaria de agradecer a minha família, por sempre acreditar em mim, me apoiar e sonhar junto. À minha mãe, que colocou meus estudos como prioridade. Ao meu pai que me ajudou e ajuda inclusive com coletas, guardando brânquias. Ainda vamos pescar muito juntos. Amo vocês!

Ao meu melhor amigo, companheiro e noivo, Carlos, que sempre me apoiou e cuidou de mim. Por todas as vezes que, mesmo sem entender nada da área, leu e tentou me ajudar com esses “bichinhos doidos”. Obrigada Carlos, amo você!

Aos meus colegas de laboratório, pelo convívio diário, sugestões e ajuda em todos os momentos que precisei. Em especial aos meus amigos Luciana, Sandra e Emanuel, além de dicas e ajuda, mas também pelos bons momentos, piadas, risadas e pão de queijo que aliviaram as dificuldades do dia a dia.

Resumo

A subclasse Copepoda é um importante constituinte do zooplâncton, e sua ausência nestes ambientes pode causar um grande desequilíbrio. Dentre esses, muitas espécies são parasitas, incluindo espécies de Ergasilidae, uma das 46 familias da ordem Poecilostomatoida. Machos e juvenis possuem hábito de vida livre enquanto as fêmeas, após fertilizadas, infectam peixes, geralmente nas brânquias. *Ergasilus* Nordmann 1832 é o gênero que possui mais espécies descritas de Ergasilidae. Entretanto, a fauna de *Ergasilus* presente na Região Neotropical é pouco conhecida. Desta forma, o presente trabalho tem como objetivo revisar as espécies de *Ergasilus* conhecidas, parasitas de peixes de água doce da região Neotropical, propor uma chave de identificação e realizer uma análise filogenética para o grupo baseando-se em caracteres morfológicos. Foram levantadas 18 espécies já descritas, das quais 15 mostraram a necessidade de redescrição. Adicionalmente foram encontradas e descritas duas novas espécies, parasitas de *Salminus spp.* A análise filogenética foi realizada utIlizando como grupo externo *E. caraguatatubensis, E. bahiensis, E. atafonensis* e *Ergasilus sp.* de peixe dragão. Dentre as principais diferenças encontradas entre as decrições originais e atual redescrição foram: 1. número de setas e presença de aestethascus na antenula; 2. número de segmentos no endopodito da perna IV; 3. presença de seta externa no coxopodito das pernas; 4. número de setas na perna V. O grupo de Ergasilideos neotropicais mostrou-se monofilético na análise filogenética morfológica com 32 caracteres. Contrariamente do que se imaginava, a filogenia indica intensa troca de hospedeiros.

Palavras-chave: Copépodes parasitos, Crustacea, peixes de água doce, *Ergasilus,* análise filogenética.

Abstract

The subclass Copepoda is an important constituent of zooplankton, and its absence in these environments can cause a major imbalance. According to EL-RASHIDY (1999), Ergasilidae is one of the 46 families of the order Poecilostomatoida . Males and juveniles have a habit of free-living, while the females, after mating, seek out and infect hosts and there remain nourishing and produzing hundreds to thousands of eggs*. Ergasilus* Nordmann 1832 is the genus that has more described species of Ergasilidae, however the fauna of *Ergasilus* present in Neotropic is little known (THATCHER, 1998). Thus, this study aims to review the *Ergasilus* known species of fish parasites of freshwater Neotropical region, propose a key identification and phylogenetic analysis for the group based on morphological characters. Eighteen described species were identify, these, fifteen showed the need for redescription, plus two new species of parasites were found in *Salminus spp*. Where necessary, the redescriptions were made, as well as the key, for this was used the Delta software. Phylogenetic analysis was performed, as outgroup was used *Ergasilus caraguatatubensis, E. bahiensis*, and *E. atafonensis* and *E.* from dragon fish. Some of the differences found between original descriptions and actual redescription are: 1. number of setae and presence os aetethascs in antenulle; 2. number of segment in endopod of leg IV; 3. presence of external seta on coxa of all legs; 4. number of setae on leg V. The phylogenetic relationship of the group proved to be monophyletic. Contrary to what could be expected, the phylogenetic relationship of the group, indicate that extensive host switching events, this is the main factor of the great diversity of the group.

Key-words: Parasitic Copepoda, Crustacea, freshwater fishes, *Ergasilus,* phylogenetic analysis.

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INTRODUCTION[1]

The subclass Copepoda is the largest and most diversified among the crustacean. Its members compose the main constituent of zooplankton, being of fundamental importance for marine and freshwater food webs (GALASSI *et al.* 2009). These crustaceans are one of the leading of vegetal matter and its absence or reduction can cause a severe imbalance in the aquatic environment. Most freshwater copepods are free-living, but they have adopted parasitism in numerous independent lineages. About 330 species of copepods in freshwater are parasitic, most commonly on fish hosts, but also on mollusks. Copepods also live as commensal epibionts on freshwater invertebrates, such as crayfishes, medusae and sponges (BOXSHALL & DEFAYE, 2008). In fishes, parasitic copepods parasitize nasal cavities, gill filaments, fins and skin. Copepod parasites have instigated the academic interest since some are highly pathogenic to their hosts and can cause large losses in fish farming (KABATA, 1970). HUYS & BOXSHALL (1991) suggest the existence of about ten orders in Copepoda, through which we have an idea of the diversity of forms. With an estimated 13,000 morphospecies known, the greatest diversity of copepods is found in the marine environment, but approximately 2,814 species inhabit freshwater (BOXSHALL & DEFAYE, 2008). According to LUQUE & TAVARES (2007), 176 species of copepods are present in fish in Brazil.

According to EL-RASHIDY (1999), Ergasilidae is one of 46 families of the order Poecilostomatoida, of which only eight have species that parasitize fishes. Species of the Ergasilidae present the second antenna modified in a prehensile organ, used to attach the parasite to the host (BOXSHALL & DEFAYE, 2008). In Ergasilidae, males, immature females, and juveniles occur in free-living zooplankton. After mating, females seek out and infect hosts for the final phase of their life cycle. Once established, the females of ergasilids feed on epithelial tissues of the host and produce hundreds to thousands of eggs receptacle (MALTA & VARELLA, 1996). In fish pounds, those who are kept in confined conditions may have a high rate of infestation, causing severe economic damage and mortality (FRYER, 1968). Ergasilids are found on and around the

[1] This work has been formatted according to the journal ZOOLOGIA.

coastal margins of all continents excluding Antarctica, and occur in all salinity regimes, although the majority can be regarded as freshwater (BOXSHALL & DEFAYE, 2008). LUQUE *et al.* (2013) reported 78 species of Ergasilidae parasitizing fishes in Brazil.

MALTA (1993) reports that Ergasilidae consists of the following genera: *Ergasilus* Nordmann, 1832; *Thersitina* Norman, 1905; *Pseudergasilus* Yamaguti, 1936; *Paraergasilus* Markewitsch, 1937; *Ostrincola*, Wilson, 1944; *Paenodes* Wilson, 1944; *Sinergasilus* Yin, 1949; *Teredophilus* Rancurel, 1954; *Neoergasilus* Yin, 1956; *Nipergasilus* Yin, 1956; *Mugiglicola* Tripathi, 1960; *Acusicola* Cressey, 1970; *Abergasilus* Hewitt, 1978; *Diergasilus* Do, 1981; *Dermoergasilus* Ho & Do, 1982; *Brasergasilus* Thatcher & Boeger, 1983; *Amplexibranchius* Thatcher & Paredes, 1985; *Rhinergasilus* Boeger & Thatcher, 1988; *Prehendorastrus* Boeger & Thatcher, 1990 and *Miracetyma* Malta, 1992. Thus, the family consists of 20 genera, but only seven occur on Neotropics: *Ergasilus, Acusicola, Brasergasilus, Amplexibranchius, Rhinergasilus, Prehendorastrus,* and *Miracetyma*. Except for *Ergasilus* and *Acusicola*, whose species have been recorded also in the South and Southeast regions of the country, all others are described from fishes of the Amazon region. AMADO *et al.* (1995), based on phylogenetic analysis, rejected Vaigamidae and included five genera of Vaigamidae in Ergasilidae. *Ergasilus* is the genus with most species of Ergasilidae, about ¾ of the known ergasilids is found in freshwater habitats and the remaining parasites are of marine fishes (HUYS & BOXSHALL, 1991). Overall, the fauna of ergasilids present in South America is poorly known (THATCHER, 1998). Despite of that, BOXSHALL & DEFAYE (2008), suggest the Neotropical Region has the second-highest richness of copepod - the first one is the Palaearctic Region – but more species should be recovered as studies increase. THATCHER (1998) suggests that our knowledge about ergasilids is incomplete and that just a tiny proportion of ergasilid fauna, especially from Amazonia, is known.

Thus, this study reviewed species of *Ergasilus* described from the freshwater fishes in the Neotropics and present the description of two new species.

MATERIAL AND METHODS

Morphology

The specimens were obtained from the collection of the Zoological Museum of Instituto Nacional de Pesquisas da Amazônia (INPA), Museu de Zoologia USP (MZUSP), the private collection of Dr. Vernon Thatcher (PVCT) and freshly collected material. Collection numbers are presented in each respective description. The specimens preserved in formalin or alcohol were cleared in Lactic Acid, dissected with glass probes, and mounted on permanent slides with Hoyer's mounting medium (HUMASON, 1979). Slides were examined under a BX51 DIC microscope; a camera lucida attached to the microscope was used to illustrate the specimens whenever necessary. All the measurements were expressed in micrometers.

With the aid of the DELTA (Description Language for Taxonomy; M.J. Dallwitz, T.A. Paine and E.J. Zurcher Version 1.0) redescriptions and identification keys for the Neotropical species of *Ergasilus* were prepared. Plates were mounted In the program CorelDRAW®.

Information on the species analysed, specimens studied and hosts are present in Table I.

Table I – Specimens of *Ergasilus* studied and respective host and museum reference.

Species	Host	Family/ Order	Studied specimens
Ergasilus bryconis Thatcher, 1981	*Brycon melanopterus* (Cope, 1872)	Characidae, Characiformes	PCVT (n=11)
Ergasilus callophysus Thatcher & Boeger, 1984	*Callophysus macropterus* (Lichtenstein, 1819)	Pimelodidae, Siluriformes	PCVT (n=13)
Ergasilus chelangulatus Thatcher & Brasil-Sato 2008	*Pimelodus maculatus* Lacepède, 1803	Pimelodidae, Siluriformes	PCVT (n=3)

Ergasilus coatiarus Araujo & Varella, 1998	*Cichla monoculus* Agassiz, 1831	Chiclidae, Perciformes	Holotype: INPA N° INPA-CR 529. Paratypes: INPA-CR 530 a-e;
Ergasilus colomesus Thatcher & Boeger, 1983	*Colomesus asellus* (Mueller & Troschel, 1849)	Tetraodontidae, Tetraodontiformes	Paratype INPA N° INPA CR 0211 PCVT (n=6)
Ergasilus holobryconis Malta & Varella, 1986	*Holobrycon pesu* Mueller & Troschell, 1845	Characidae, Characiformes	Paratype: INPA N° INPA-CR-382a – h
Ergasilus hydrolicus Thatcher *et al.,* 1984	*Hydrolicus scomberoides* (Cuvier, 1819)	Cynodontidae, Characiformes	Holotype: INPA N° INPA CR-022 Paratype: INPA N° INPA CR-023a- g PCVT (n=3)
Ergasilus hypophthalmus Boeger *et al.,* 1993	*Hypophthalmus edentatus* Spix & Agassiz, 1829	Pimelodidae, Silurifomes	Holotype: INPA N° INPA CR 483. Paratype: INPA N° 484a-b;
Ergasilus jaraquensis Thatcher & Robertson, 1982	*Semaprochilodus insignis* (Jardine, 1841)	Prochilodontidae, Characiformes	PCVT (n=5)
Ergasilus leporinidis Thatcher, 1981	*Leporinus fasciatus* (Bloch, 1794)	Anostomidae, Characiformes	PCVT (n=3)
Ergasilus pitalicus Thatcher, 1984	*Cichlassoma sp.*	Chiclidae, Perciformes	PCVT (n=6) Paratype: INPA-CR 024m
Ergasilus salmini Thatcher & Brasil-Sato, 2008	*Salminus franciscanus* Lima & Britski, 2007	Characidae, Characiformes	PCVT (n=5)
Ergasilus sp. n. 2	*Salminus brasiliensis (Cuvier, 1816)*	Characidae, Characiformes	PVCT (n= 3)
Ergasilus sp. n. 3	*Salminus franciscanus Lima & Britski, 2007*	Characidae, Characiformes	PVCT (n= 8)
Ergasilus thatcheri Enger *et al.,* 2000	*Rhamdia quelen* (Quoy & Gaimard, 1824)	Heptapteridae, Siluriformes	PCVT (n=13)
Ergasilus triangularis Malta, 1994	*Laemolyta taeniata (*Kner, 1858)	Anostomidae, Characiformes	Holotype: INPA: N° INPA-CR 619. Paratype: INPA N° INPA-CR-706a-b; 707a-e

Ergasilus trygonophilus Domingues & Marques, 2010	*Potamotrygon spp; Plesiotrygon iwamae* (Rosa, Castello & Thorson, 1987)	Potamotrygonidae, Myliobatiformes	PCVT (n=5)
Ergasilus turucuyus Malta & Varella, 1996	*Acestrorhynchus falcatus* (Bloch, 1794)	Acestrorhynchidae, Characiformes	Holotype: INPA N° INPA-CR 616. Paratype: INPA N° INPA-CR-617 a-h; 703a-e PCVT (n=2)
Ergasilus urupaensis Malta 1993	*Prochilodus nigricans* Spix & Agassiz, 1829	Prochilodontidae, Characiformes	Holotype: INPA N° INPA-CR 614. Paratype: INPA N° INPA-CR 615 a-f;
Ergasilus yumaricus Malta & Varella, 1995	*Pygocentrus nattereri* Kner, 1858	Serrasalmidae, Characiformes	Holotype: INPA N° INPA-CR 622. Paratype:INPA N° INPA-CR 623 a-d; 709; 710a-b; 711a-g; 712a-c; 713a-c

*PCVT = personal collection of Dr. V. E. Thatcher. Specimens will be deposited in credited collection prior to publication of this study. INPA = collection of the Instituo Nacional de Pesquisas da Amazônia. MZUSP = Museu de Zoologia da Universidade de São Paulo.

Phylogenetic Analysis

The character states for each species were defined from the morphological analysis after restudy of representative specimens of each species. From the matrix prepared with DELTA, a matrix of morphological characters was exported into **nexus** format. The phylogenetic analysis was performed with PAUP* (Phylogenetic Analysis Using Parsimony, Version 2.4.1; Swofford, Illinois Natural History Survey, Champaign) using heuristic search and 1000 replicates with random sequence adition followed by successive weighting until stabilization of the consistency index. Thirty-two characters (homologous series) were used in analysis (see below). *Ergasilus atafonensis* Amado & Rocha, 1995, *E. caraguatatubensis* Amado & Rocha, 1995*, E. bahianensis* Amado & Rocha, 1995 – all from mugilid fishes (*Mugil liza, M. curema, M. trichodon, M. platanus* and *M. gaimardianus*) and *E. n. sp.* from *Gobioides broussonnetii*

Lacépède, 1800 were used as outgroup for a posteriori rooting of the cladogram. These species are parasites of brackish and marine fishes.

Character analysis

Less characters were used in the phylogenetic analysis than in descriptions and key, were selected characters that can't made misinterpretation, like presence or absence of spinules. Characters used in analysis follow. Numbers in parentheses preceding a character state refer to the code in the matrix.

Chephalotorax

(1) *Cephalotorax:* (1) twice as long than wide; (2) less than twice the width.

(2) *Relative length of cephalotorax:* (1) nearly 50% of body length; (2) shorter than 50% of body length; (3) longer than 50% of body length

(3) *Cephalotorax and first pedigerous:* (1) fused; (2) partly fused; (3) not fused.

Antenna

(4) *Setae on coxa:* (1) present; (2) absent

(5) *Length/width ratio of first endopodal segment of antenna:* (1) larger than 3; (2) smaller than 3; (3) approximately 3.

(6) *Cuticular elevation on sensillum of first endopodal segment:* (1) absent; (2) present.

(7) *Sensillum on first endopodal segment of antenna:* (1) proximal; (2) distal; (3) near midlength.

(8) *Internal margin of first* endopodal segment of antenna: (1) with spines; (2) lacking spines.

(9) *Second segment of antenna:* (1) curved and shorther than first one; (2) shorter than first segment; (3) curved, as long as first segment; (4) curved, longer than first segment.

(10) *Number of sensila on second segment of antenna:* (1) two; (2) one; (3) lacking sensillum

(11) *Proximal sensillum on second segment:* (1) small; (2) strong; (3) absent.

(12) *Seta on third segment of antenna (when present):* (1) present; (2) absent.

(13) *Claw:* (1) proximaly recurved at about 90 degrees; (2) evenly curved.

Legs

(14) *Position of spines on interpodal sclerites:* (1) distal row; (2) lacking spines; (3) ventrally.

Leg 1

(15) *Posterior seta on basis:* (1) present; (2) absent.

(16) *Distal spine on second segment:* (1) present; (2) absent.

(17) *Third segment of exopod of leg I:* (1) with one pectinated seta and four pilose setae; (2) lacking pectinated seta, with four pilose setae; (3) lacking pectinated seta, with five pilose setae.

(18) *Two distal spines on third segment of exopod:* (1) with spinules; (2) lacking spinules; (3) only the outer spine with spinules; (4) one of them with membrane o outer margin.

(19) *Number of segments on endopod of leg I:* (1) two; (2) three.

(20) Number of setae on second segment of endopod of leg I: (1) one; (2) two; (3) five; (4) four.

(21) Shape of spines on second segment of endopod of leg I (when present): (1) absent; (2) straight; (3) curved; (4) long, one curved.

(22) Spines on second segment of endopod of leg I: (1) both ornated with spinules; (2) only one with spinules; (3) lacking spinules; (4) one of them ornated with a serrate membrane; (5) both ornated with serrate membrane.

Leg II and III

(23) First segment of exopod of legs II and III: (1) twice as long than wide; (2) less than twice the width.

(24) Distal spine on first segment of exopod of legs II and III: (1) absent; (2) present, with spinules on outer margin; (3) present, lacking spinules.

(25) Distal spine on third segment of endopod of legs II and III: (1) present; (2) absent; (3) present with spines; (4) present with a membrane.

Leg IV

(26) Distal spine on first segment of exopod of leg IV: (1) absent; (2) present and ornated with spinules; (3) present.

(27) Number of setae on second segment of exopod of leg IV: (1) four; (2) five.

(28) Number of segments on endopod of leg IV: (1) two; (2) three.

(29) Distal spine on second segment of endopod of leg IV: absent; (2) present; (3) present ornated with spinules.

(30) Number of setae on second segment of endopod of leg IV: (1) two; (2) four; (3) five.

Leg V

(31) Leg V reduced to: (1) two distal setae, one longer than other; (2) one single seta; (3) three setae and spinules.

Caudal rami

(32) Number and size of setae on caudal rami: (1) one long, one median and two short setae; (2) one long and three short setae; (3) one long, one medium and three short setae; (4) one long, two medium and two short setae.

RESULTS

Identification key for neotropical freshwater species of *Ergasilus*

Less characters were used in the key (52 characters) than in descriptions, were selected characters that can't made misinterpretation, like presence or absence of spinules. All the characters are present in appendix.

1. Third exopod segment of leg I with one pectinated seta and four pilose setae 2

Third exopod segment of leg I lacking pectinated seta, with five pilose setae 13

2(1). Two distal spines on third exopod segment with spinules 3

Two distal spines on third exopod segment lacking spinules 8

Two distal spines on third exopod segment one of them with membrane on the outer margin. ..... ***Ergasilus trygonophilus***

3(2). Cephalotorax and first pedigerous fused.....

Cephalotorax and first pedigerous partly fused 4

Cephalotorax and first pedigerous not fused 7

4(3). Relative length of cephalotoraxnearly 50% of body length; Proximal sensillum small 5

Relative length of cephalotorax longer than 50% of body length; Proximal sensillum strong 6

5(4). Length/width ratio of first endopodal segment of antenna larger than 3; Sensilum on first endopodal segment of antenna distal; Internal margin of first endopodal segment of the antenna with spines; Second endopodal segment of antenna curved and shorter than first segment .....…

……***Ergasilus thatcheri***

Length/width ratio of first endopodal segment of antenna smaller than 3; Sensilum on first endopodal segment of antenna near midlength; Internal margin of first endopodal segment of the antenna lacking spine; Second endopodal segment of antenna shorter than first segment……***Ergasilus hypophthalmi***

6(4). Cuticular elevation on sensillum of first endopodal segment absent; Sensilum on first endopodal segment of antenna distal; Internal margin of first endopodal segment of the antenna with spines……***Ergasilus salmini***

Cuticular elevation on sensillum of first endopodal segment present; Sensilum on first endopodal segment of antenna near midlength;

Internal margin of first endopodal segment of the antenna lacking spine ..... …….. ***Ergasilus callophysus***

7(3). Relative length of cephalotorax nearly 50% of body length; Length/width ratio of first endopodal segment of antenna smaller than 3; Second endopodal segment of antenna shorter than first segment; Spines on second endopod segment of leg I straight……..***Ergasilus turucuyus***

Relative length of cephalotorax longer than 50% of body length; Length/width ratio of first endopodal segment of antenna larger than 3; Second endopodal segment of antenna curved and shorter than first segment; Spines on second endopod segment of leg I curved.....…… ……... ***Ergasilus bryconis***

8(2). Relative length of cephalotorax nearly 50% of body length; Aesthetascs absent or not observed…… ***Ergasilus hydrolicus***

Relative length of cephalotorax shorter than 50% of body length; Aesthetascs one on fifth and three on sixth segment…… ***Ergasilus urupaensis***

Relative length of cephalotorax longer than 50% of body length; Aesthetascs present on fifth and sixth segment.....9

9(8). Length/width ratio of first endopodal segment of antenna larger than 3 10

Length/width ratio of first endopodal segment of antenna smaller than 3 11

10(9). Cephalotorax and first pedigerous partly fused; Coxa of antenna lacking seta; Second endopodal segment of antenna curved and shorter than first segment; Second endopodal segment with two sensila…… ***Ergasilus triangularis***

Cephalotorax and first pedigerous not fused; Coxa of antenna presenting a short distal seta; Second endopodal segment of antenna shorter than first segment; Second endopodal segment with one sensillum..... …… ……. ***Ergasilus jaraquensis***

11(9). Sensilum on first endopodal segment of antenna distal; Second endopodal segment with two sensila; Spines on second endopod

segment of leg I curved; Abdominal segments lacking spines..... ….
……..***Ergasilus yumaricus***

Sensilum on first endopodal segment of antenna near midlength; Second endopodal segment with one sensillum; Spines on second endopod segment of leg I straight; Abdominal segments with spines on entire posterior margin..... 12

12(11). Second endopodal segment of antenna curved and shorter than first segment; Mandible with anterior, median, posterior blades; Two setal elements on maxilulle present; Second exopod segment of leg I lacking seta…… ***Ergasilus sp. n*. 2**

Second endopodal segment of antenna shorter than first segment; Mandible with median and posterior blades; anterior blade absent; Two setal elements on maxilulle absent or not observed; Second exopod segment of leg I with one seta…….. ***Ergasilus holobryconis***

13(1). Cephalotorax and first pedigerous fused; Aesthetascs absent or not observed…… ***Ergasilus colomesus***

Cephalotorax and first pedigerous partly fused; Aesthetascs two on fifth and three on sixth segment.....***Ergasilus leporinidis***

Cephalotorax and first pedigerous not fused; Aesthetascs present on fifth and sixth segment.....14

14(13). Relative length of cephalotorax nearly 50% of body length; Cuticular elevation on sensillum of first endopodal segment absent; Two distal spines on third exopod segment lacking spinules; Coxa of antenna presenting a short distal seta……..***Ergasilus sp. n.* 3**

Relative length of cephalotorax longer than 50% of body length; Cuticular elevation on sensillum of first endopodal segment present; Two distal spines on third exopod segment with spinules; Coxa of antenna lacking seta……...***Ergasilus pitalicus***

Taxonomy

Among the eighteen species, only three did not require redescription. The original descriptions of *E. hydrolicus, E. thatcheri and E. trygonophilus* are considered adequate. The remaining species were redescribed below.

Ergasilus bryconis Thatcher, 1981

Figures1-8

Redescription based on 11 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, two endopodal segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum small; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment; setal formula: 1-10-4-4-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules on entire outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment lacking spinules, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines curved, both ornate with spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first

segment pilose on inner side, lacking seta, with spinules distally on outer margin, outer spine present with spinules on outer margin; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present and ornate with spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, with an external seta. Exopod with 2 segments; first segment with spinules distally on outer margin, pilose, lacking seta, distal outer spine present; second segment with spinules on entire outer margin, with four setae, distal spine present. Endopod with 2 segments; first segment with spinules on entire outer margin, with one seta; pilose; second segment with spinules on entire outer margin, with five setae, distal outer spine present ornate with spinules. Number and distribution of spines and setae of legs I-IV are presented in Table II. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setas on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac not observed.

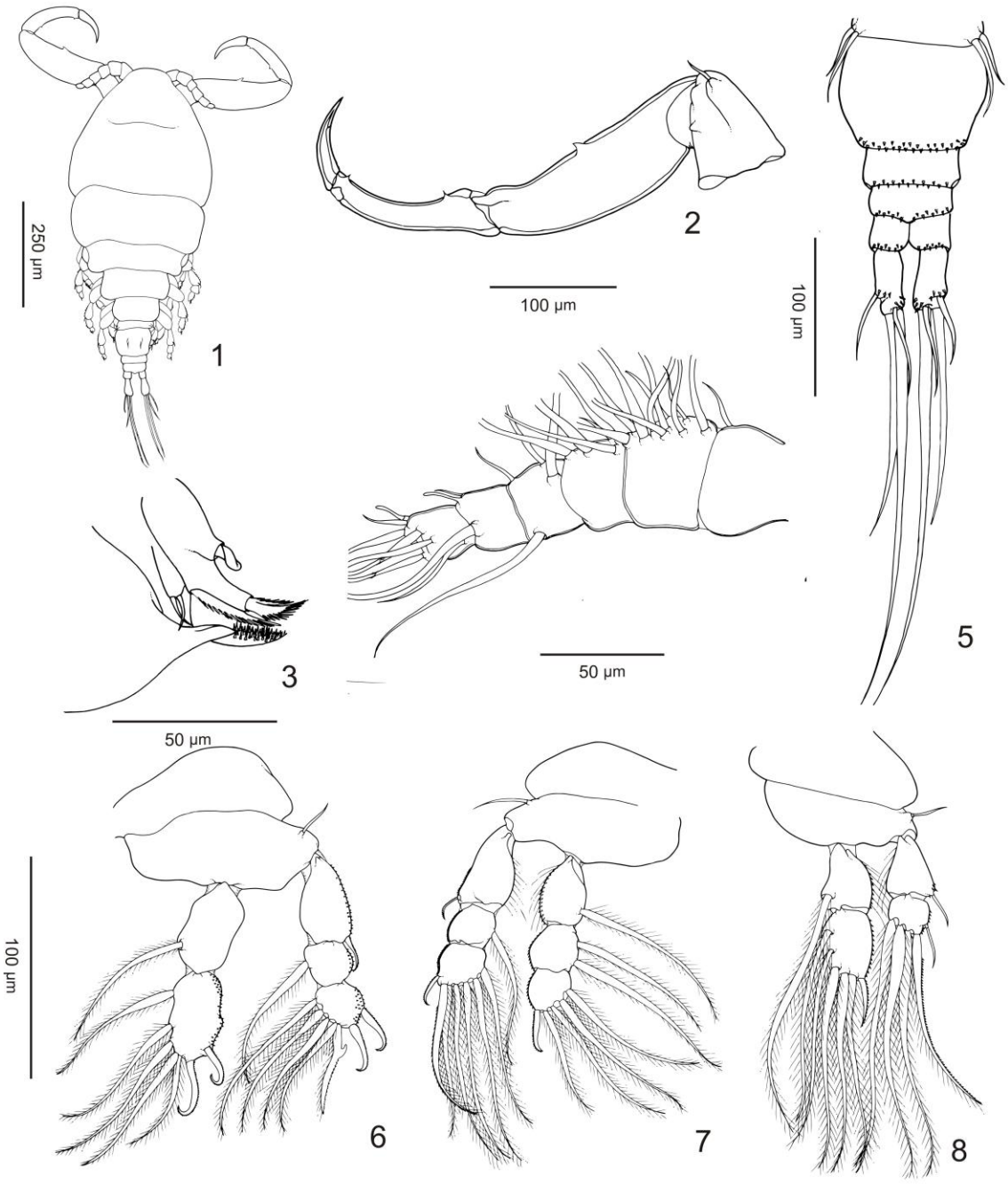
Table II: Spines and setal formula of the legs of *Ergasilus bryconis.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Brycon melanopterus* (Cope, 1872)
Site: Gill filaments.
Locality: Manaus, Amazonas, Brazil.
Male: Unknown.

REMARKS: The study of the type specimens of *E. bryconis* revealed some features that were either mistakingly described or ignored in the original description. Among these, most are structutres of small size or difficult to visualize (e.g. sensillum and setae) and others were structures unknow to occur in species of the genus at the time of the description (e.g. aesthetascs). *Ergasilus bryconis* was originally described with a single sensillum in the first endopodal segment of the second pair of antennae but restudy of the specimens detected other subterminal sensilla, each subterminal on the second endopodal segment of the antenna. Other differences include: 1. number of setae and aesthetascs on the first antenna 2. setae and spines on legs; and 3. ornamentation of the abdominal segments and caudal rami.



Figures 1-8: *Ergasilus bryconis*, adult female. (1) dorsal view; (2) antenna; (3) mouth parts; (4) antennule; (5) abdomen and caudal rami; (6) leg I; (7) leg II=leg III; (8) leg IV. Scales: 1= 250 µm; 2, 5= 100 µm; 3, 4= 50 µm; 6, 7, 8= 100 µm

Ergasilus callophysus Thatcher & Boeger, 1984

Figures 9-16

Redescription based on 13 adult female: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous partially fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum larger than distal; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs two on fifth and three on sixth segment, setal formula: 1-10-5-4-1-4. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I**. Basis with smooth margins, spinules absent, lacking an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules on entire outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with distal spinules on outer margin, with five setae, spines straight, both ornate with spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment not pilose, lacking seta, with spinules on all outer margin, outer spine present with spinules on outer margin; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present and ornate with

spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis ornate with spinules, with an external seta. Coxa with spinules. Exopod with 2 segments; first segment with spinules on entire outer margin, pilose, lacking seta, distal outer spine present; second segment with spinules on entire outer margin, with four setae, distal spine present. Endopod with 2 segments; first segment with spinules distally on outer margin, with one seta, pilose; second segment with spinules on entire outer margin, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table III. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking seta on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac elongate**.**

Table III: Spines and setal formula of the legs of *Ergasilus callophysus.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary

Host: *Callophysus macropterus* (Lichtenstein, 1819)

Site: Gill filaments.

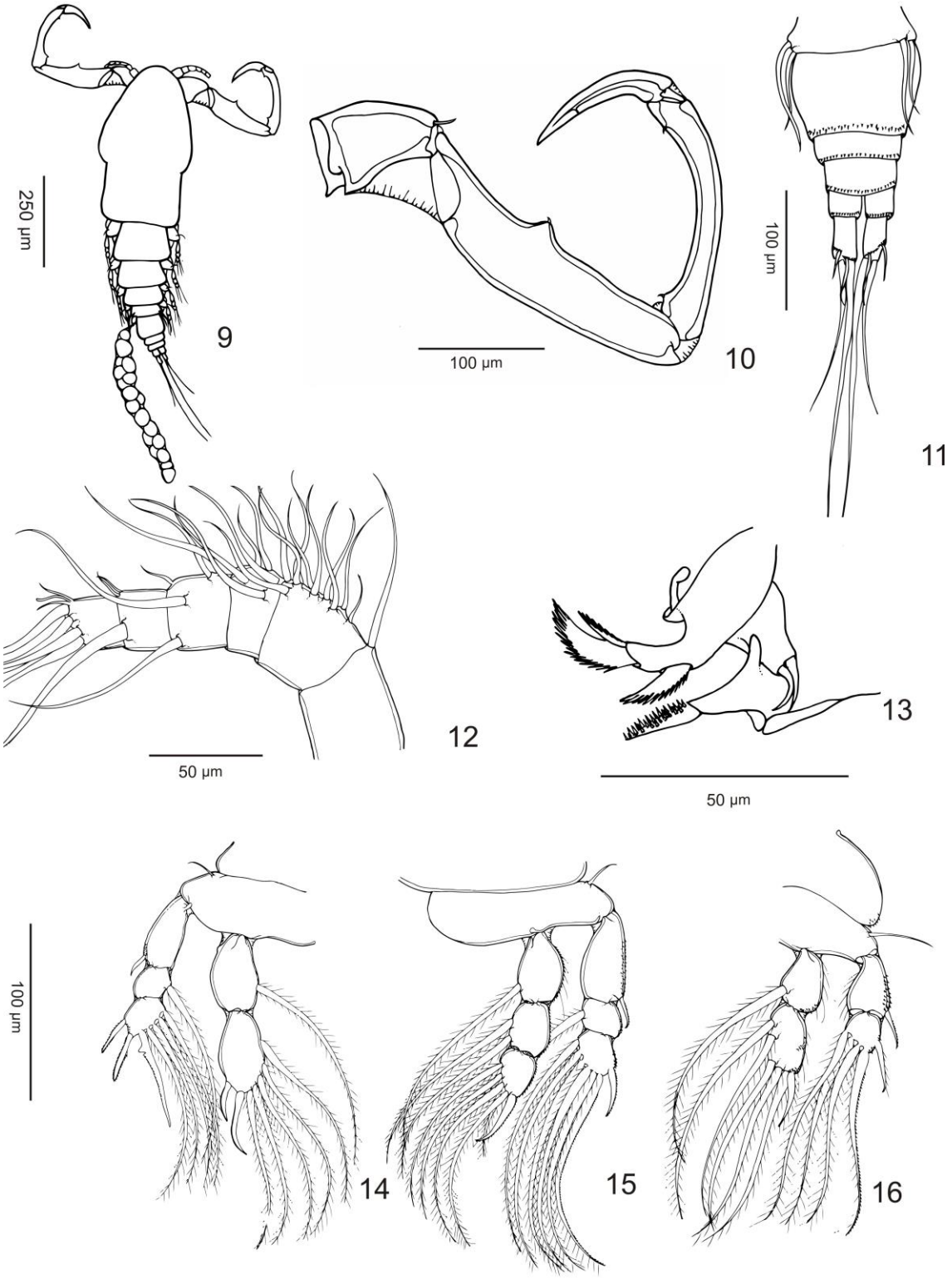
Locality: Amazon River, near Manaus, Amazonas, Brazil.

Male: Unknown.

REMARKS:

The only difference found between the original description and the current was related to the number of segments of the endopod of leg IV. This structure

was described by THATCHER & BOEGER (1984) with three segments but the studied specimens presented only two segments; the second segment is long and apparently caused the misinterpretation.



Figures 9-16: ***Ergasilus callhophysus*****, adult female. (9) dorsal view; (10) antenna; (11) abdomen, caudal rami; (12) antennule; (13) mouth parts; (14) leg I; (15) leg II=leg III; (16)leg IV. Scales: 9= 250 µm, 10, 11= 100 µm, 12, 13= 50 µm, 14F, G, H= 100 µm**

Ergasilus chelangulatus Thatcher & Brasil-Sato, 2008

Figures 17-24

Redescription based on 4 adult female: Cephalossome not inflated, cephalothorax twice as long than wide, longer than 50% of body length; cephalothorax and first pedigerous fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna sub-distal, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum larger than distal; third endopodal segment lacking seta or not observed; claw proximally recurved at about 90 degrees. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-12-2-3-5-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates with spinules ventrally. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod with spinules distally on outer margin, pilose, lacking seta, distal spine on outer margin present; second segment of exopod with distal spinules on outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules distally on outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines straight, both ornate with spinules**. Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules on all outer margin, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present

lacking spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table IV. **Leg IV.** Basis lacking spinules, with an external seta. Exopod with 2 segments; first segment lacking spinules, not pilose, lacking seta, distal outer spine present; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment with spinules distally on outer margin, with one seta; pilose; second segment with spinules on entire outer margin, with five setae, distal outer spine present. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking seta on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac elongate.

Table IV: Spines and setal formula of the legs of *Ergasilus chelangulatus,*

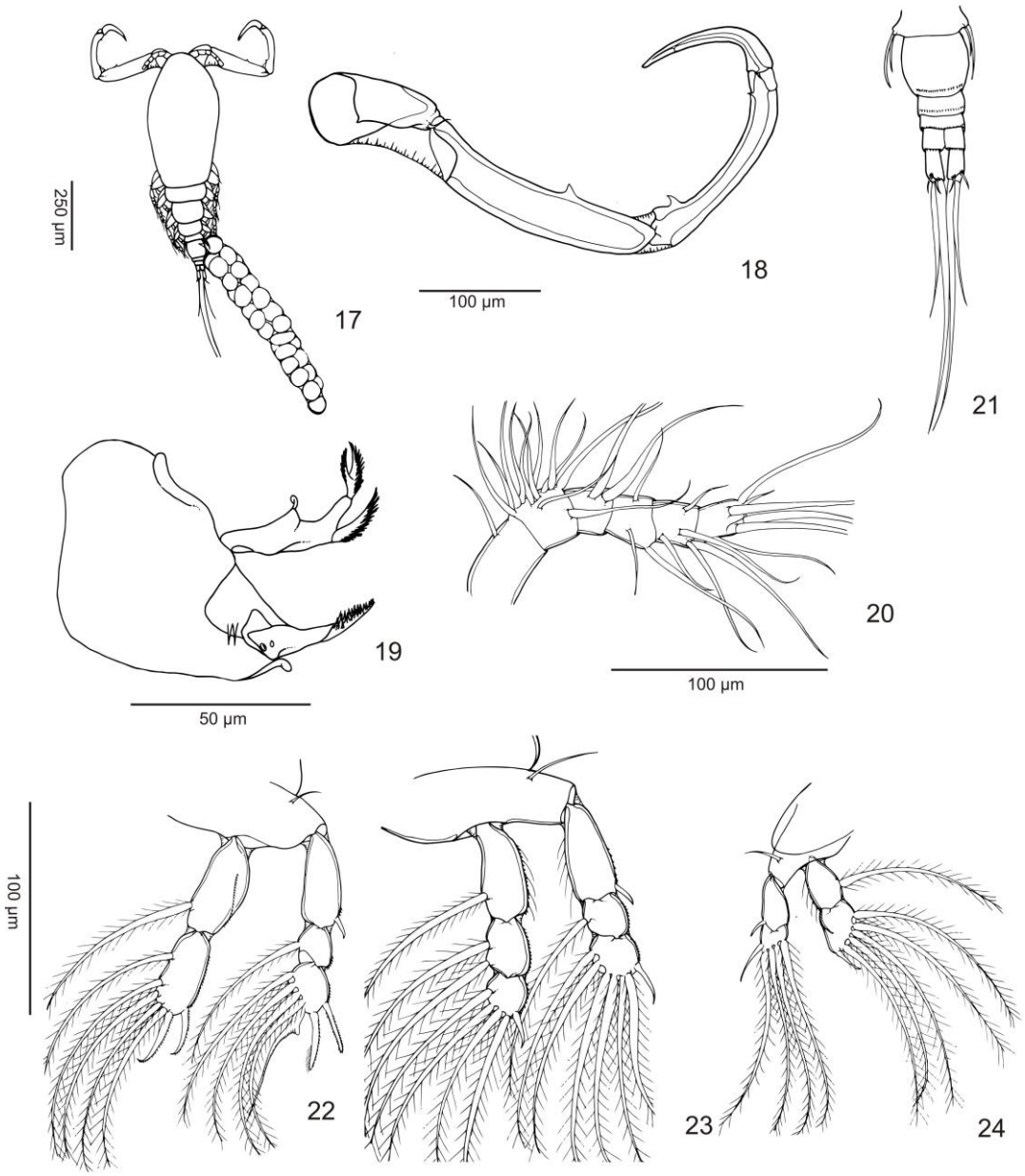
	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Pimelodus maculatus* Lacepède, 1803
Site: Gills filaments.
Locality: São Francisco River, downstream from the Três Marias Dam, State of Minas Gerais, Brazil.
Male: Unknown.

REMARKS: Several misinterpretations of the species morphology was detected with re-study of the present specimens: 1. The rostrum has no anterior projection as originally described; 2. the second antenna presents a seta on the

coxobase and a distal sensilla in the second endopodal segment; 3. The number of setae and the presence of aesthestascs in the fifth and sixth segments differ from the originally described. 4. The mandible was described originally containing only two blades, but it contains three blades; setal elements are present in maxilla and the base of the mandible is serrated on convex margin and not just the posterior region as described previously. 5. The ornamentation on legs 1-4 present differences from THATCHER & BRASIL-SATO (2008) description; 6. The abdominal segments present spinules.



Figures 17-24: *Ergasilus chelangulatus*, adult female. (17) dorsal view; (18) antenna; (19) mouth parts (20) antennule; (21) abdomen, caudal rami; (22) leg I; (23) leg II=leg III; (24) leg IV. Scales: 17= 250 µm, 18, 20, 21= 100 µm, 19= 50 µm, 22, 23, 24= 100 µm

Ergasilus coatiarus Araujo & Varella, 1998

Figures 25-32

Redescription based on 9 adult females (paratypes). Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna approximately 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna sub-distal, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-10-5-4-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle absent or not observed. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, lacking an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod lacking pectinate seta, with five pilose setae, with spinules on entire outer margin, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines one long spine and one small spine, lacking spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules on all outer margin, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present lacking spinules.

Endopod with 3 segments; first segment with spinules on entire outer margin, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine present lacking spinules; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, with an external seta. Exopod with 1 segment; first segment with spinules distally on outer margin, not pilose, with four setae, distal outer spine present; Endopod with 2 segments; first segment with spinules on entire outer margin, with one seta; pilose; second segment lacking spicules, with five setae, distal outer spine absent. Number and distribution of spines and setae of legs I-IV are presented in Table V. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, with lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac short.

Table V: Spines and setal formula of the legs of *Ergasilus coatiarus*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	I-0	I-0; 0-1; II*-4	0-1; II-5
Leg II	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary

Host: *Cichla monoculus* Agassiz, 1831

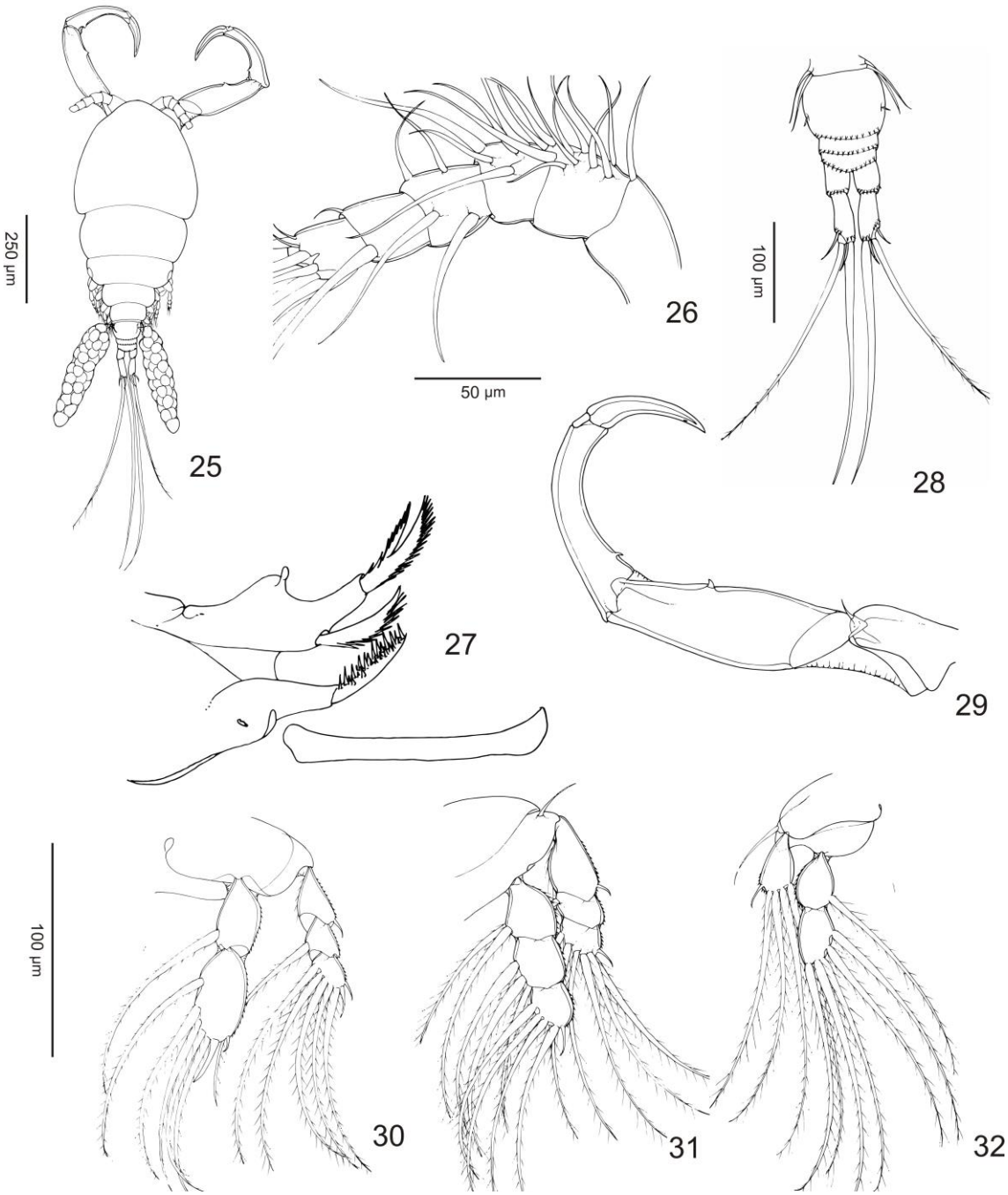
Site: Gills filaments.

Locality: Solimões river, Marchantaria island, near Manaus, Amazonas State, Brazil.

Male: Unknown.

REMARKS: In the original description *E. coatiarus* was considered close to *E. hydrolicus* since both species have the leg V reduced to a single seta, but in the specimens available for the present study the fifth leg of *E. coatiarus* consists of two setae, as most *Ergasilus* species in the neotropical region. In the original

description, ornamentation in the legs were not described and the authors suggest that legs II and III are different - However, legs II and III are similar, both with three segments in exopod and endopod with the third segment with a terminal spine and four pilose setae. A feature not seen previously is the presence of two short setae in the caudal rami besides the median and long setae mentioned in the original description.



Figures 25-32: Ergasilus coatiarus, adult female. (25) dorsal view; (26) antennule; (27) mouth parts; (28) abdomen, caudal rami; (29) antenna; (30) leg I; (31) leg II=leg III; (32) leg IV. Scales: 25= 250 µm, 26, 27= 50 µm, 28, 29, 30, 31, 32=100 µm

Ergasilus colomesus Thatcher & Boeger, 1983

Figures 33-40

Redescription based on 5 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous fused. Antenna with coxa, three endopod segments, claw; coxa lacking seta, membrane between coxa and the first segment of endopod inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment shorter than first segment, presenting one sensillum; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs absent or not observed, setal formula: 1-5-2-5-1-4. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla completely toothed, spinulose seta on maxilla absent; two setal elements on maxilulle absent or not observed. Interpodal plates with distal row of spinules. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod lacking pectinate seta, with five pilose setae, lacking spinules, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with four setae, spines straight, lacking spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment not pilose, lacking seta, lacking spinules, outer spine absent; second segment with spinules distally on outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine absent. Endopod with 3 segments; first segment lacking spinules, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third

segment with spinules on entire outer margin, with five setae, distal outer spine absent. **Leg IV.** Basis ornate with spinules, lacking an external seta. Exopod with 2 segments; first segment with spinules on entire outer margin, not pilose, lacking seta, distal outer spine absent; second segment with spinules on entire outer margin, with four setae, distal spine present. Endopod with 3 segments; first segment lacking spinules, with one seta; pilose; second segment with spinules distally on outer margin, with two setae, distal outer spine present; third segment with spinules on entire outer margin, with three setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table VI. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, two medium and two short setae, spinules present. Egg sac not observed.

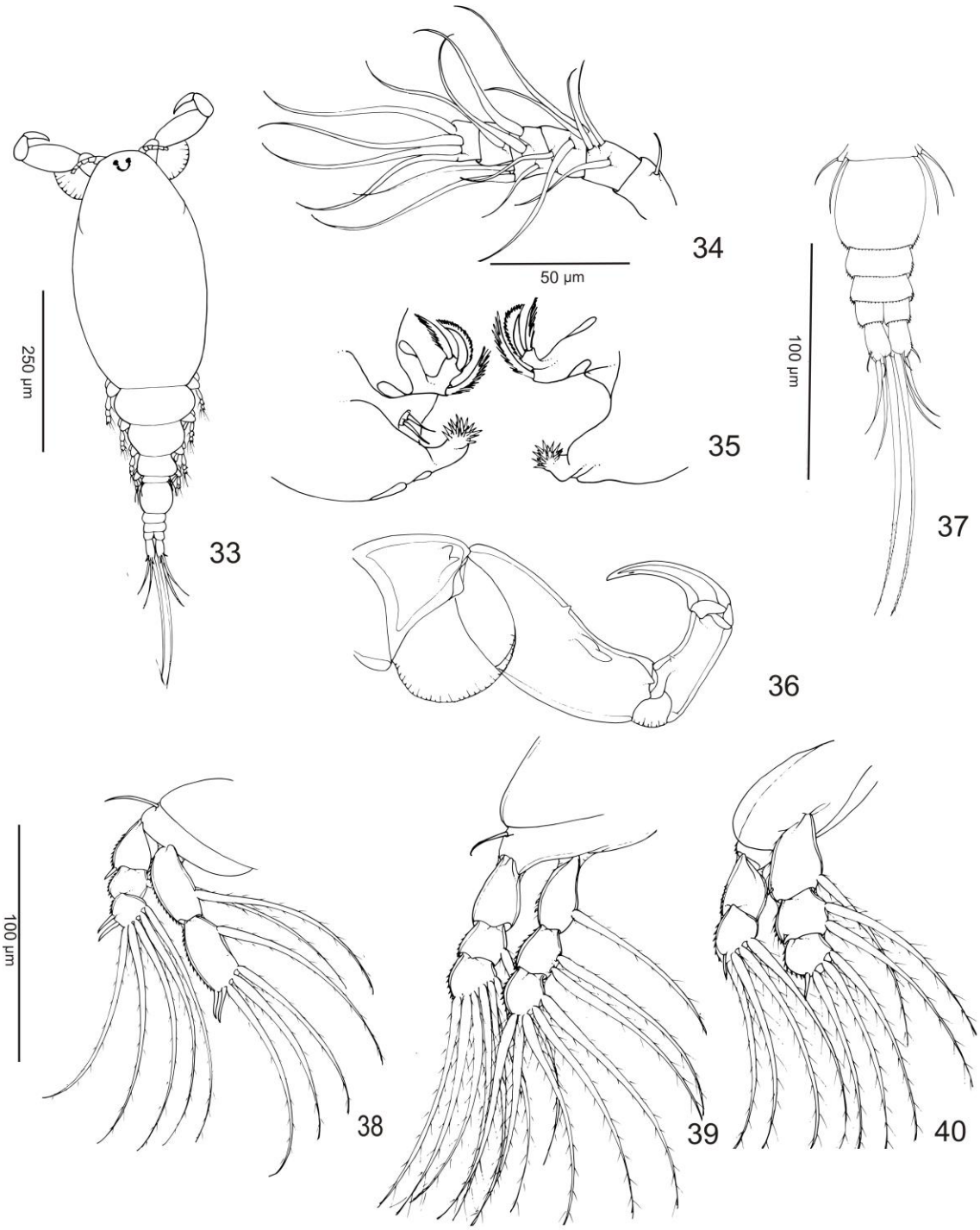
Table VI: Spines and setal formula of the legs of *Ergasilus colomesus*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	I-0	I-0; 0-1; II*-4	0-1; II-5
Leg II	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Colomesus asellus* (Mueller & Troschel, 1849)
Site: Gills filaments.
Locality: Amazon River, Manaus, Amazonas, Brazil.
Male: Unkown.

REMARKS: In the original description, some structures were not reported, such as a sensillum in the middle region of the first endopodal segment of antenna; spinules on abdominal segments; five setae in the third segment of the endopod of leg I. Setal elements in maxilulle are reported for the first time in this study.



Figures 33-40: *Ergasilus colomesus*, adult female. (33) dorsal view; (34) antennule; (35) mouth parts; (36) antenna; (37) abdomen, caudal rami; (38) leg I; (39) leg II=leg III; (40)leg IV. Scales: 33= 250 µm, 34, 35= 50 µm, 36, 37, 38, 39, 40=100 µm

Ergasilus holobryconis Malta & Varella, 1986

Figures 41-48

Redescription of 9 adult females: Cephalossome not inflated, cephaphothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment shorter than first segment, presenting one sensillum; third endopodal segment with a single seta at the articulating membrane; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-10-2-2-1-4. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle absent or not observed. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod lacking spinules, pilose, lacking seta, distal spine on outer margin present; second segment of exopod with distal spinules on outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, lacking spinules, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines straight, one of them ornate with a serrate membrane. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules distally on outer margin, outer spine present, lacking spinules; second segment lacking spinules, with one seta, distal outer spine absent; third segment with spinules distally on outer margin, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment with

spinules on entire outer margin, pilose, with one seta; second segment lacking spinules, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, with an external seta. Exopod with 2 segments; first segment with spinules distally on outer margin, not pilose, lacking seta, distal outer spine present; second segment with spinules distally on outer margin, with four setae, distal spine present. Endopod with 2 segments; first segment with spinules on entire outer margin, with one seta; pilose; second segment with spinules distally on outer margin, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table VII. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac short.

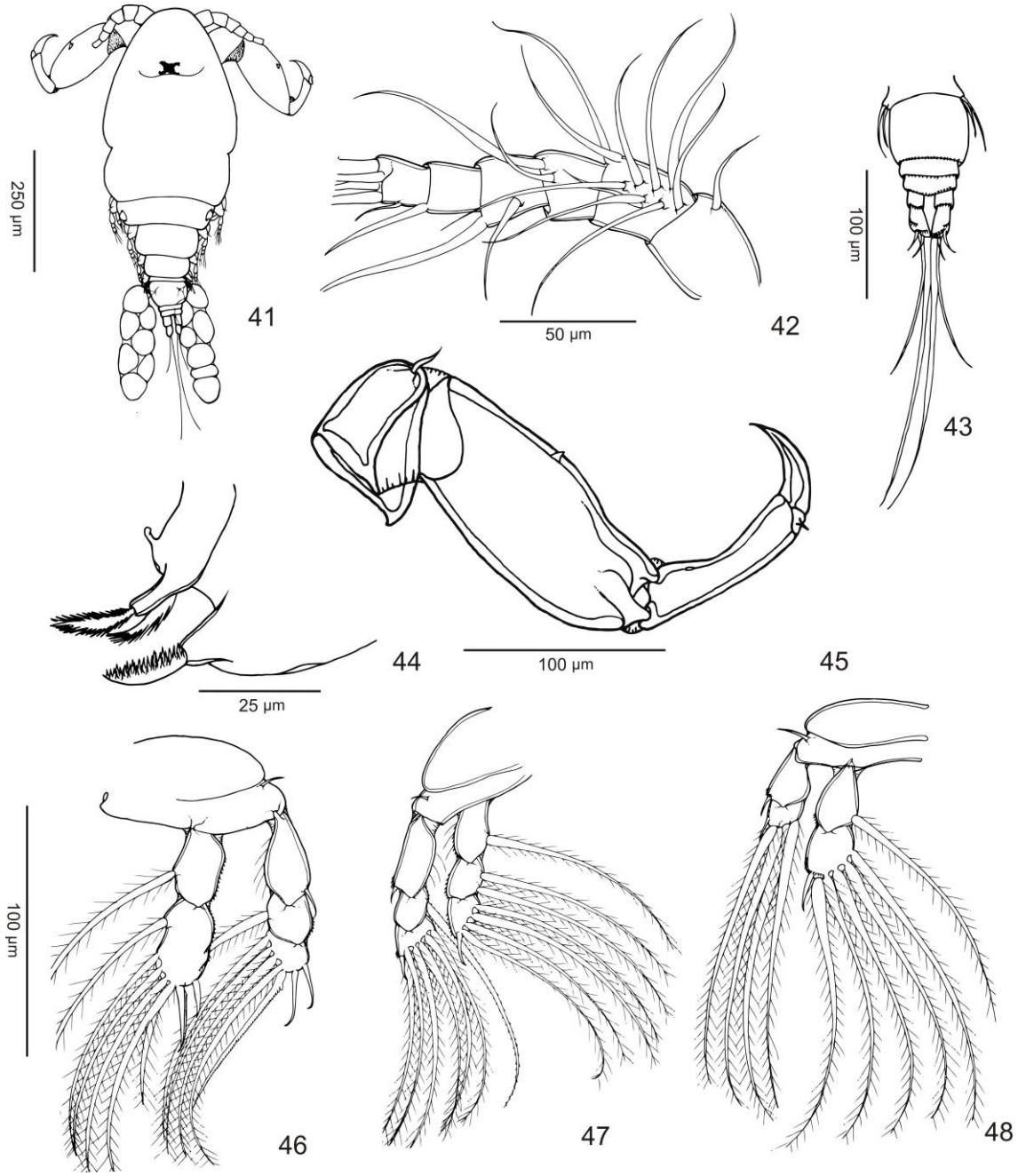
Table VII: Spines and setal formula of the legs of *Ergasilus holobryconis.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Holobrycon pesu* Mueller & Troschell, 1845
Site: Gills filaments.
Locality: Ji-Paraná River, city of Machado, State of Rondônia, Brazil.
Male: Unknown.

REMARKS: Among the differences observed from the original description of MALTA & VARELLA (1986), the studied specimens presented: 1. Sensillum in the median region of the first endopodal segment of the antenna and seta on the coxa and third endopodal segment; 2. spinules on the seta of the second segment of the exopod of legs II and III.



Figures 41-48: *Ergasilus holobryconis*, adult female. (41) dorsal view; (42) antennule; (43) abdomen, caudal rami; (44) mouth parts; (45) antenna; (46) leg I; (47) leg II=leg III; (48)leg IV. Scales: 41= 250 µm, 42= 50 µm, 43, 45= 100 µm, 44= 25 µm, 46, 47, 48= 100 µm.

Ergasilus hydrolycus Thatcher, Boeger & Robertson, 1984

Taxonomic Summary
Host: *Hydrolycus scomberoides* (Cuvier, 1819)
Site: Gills filaments.
Locality: Marchantaria Island, near Manaus, Amazonas, Brazil
Male: Unknown.

Specimens studied: Holotype INPA-CR 022 Paratypes: INPA-CR 023a, INPA-CR 023b, INPA-CR 023c, INPA-CR 023d, INPA-CR 023e, INPA-CR 023f, INPA-CR 023g.

REMARKS: Just a small diference was observed in the original description. Both segments of endopod of leg IV are pilose and there are rows of spinules on outer margin. Otherwise, the description presented by THATCHER, BOEGER & ROBERTSON, 1984 is appropriate.

Ergasilus hypophthalmi Boeger, Martins & Thatcher, 1984

Figures 49-57

Redescription based on 6 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, nearly 50% of body length; cephalothorax and first pedigerous partially fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod, not inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-10-5-3-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with median and posterior blades; anterior blade absent; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I.** Basis with smooth

margins, spinules present, lacking external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with distal spinules on outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, lacking spinules, two distal outer spines with spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines curved, both ornate with spinules. **Legs II and III.** Basis ornate with spinules, lacking an external seta. Coxa with spinules. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules on all outer margin, outer spine present with spinules on outer margin; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present and ornate with spinules. Endopod with 3 segments; first segment with spinules distally on outer margin, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present with spines. **Leg IV.** Basis lacking spinules, with an external seta. Coxa with spinules. Exopod with 2 segments; first segment with spinules distally on outer margin, pilose, lacking seta, distal outer spine present; second segment with spinules on entire outer margin, with four setae, distal spine present with spinules on outer margin; Endopod with 2 segments; first segment with spinules on entire outer margin, with one seta; not pilose; second segment with spinules on entire outer margin, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table VIII. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac not observed.

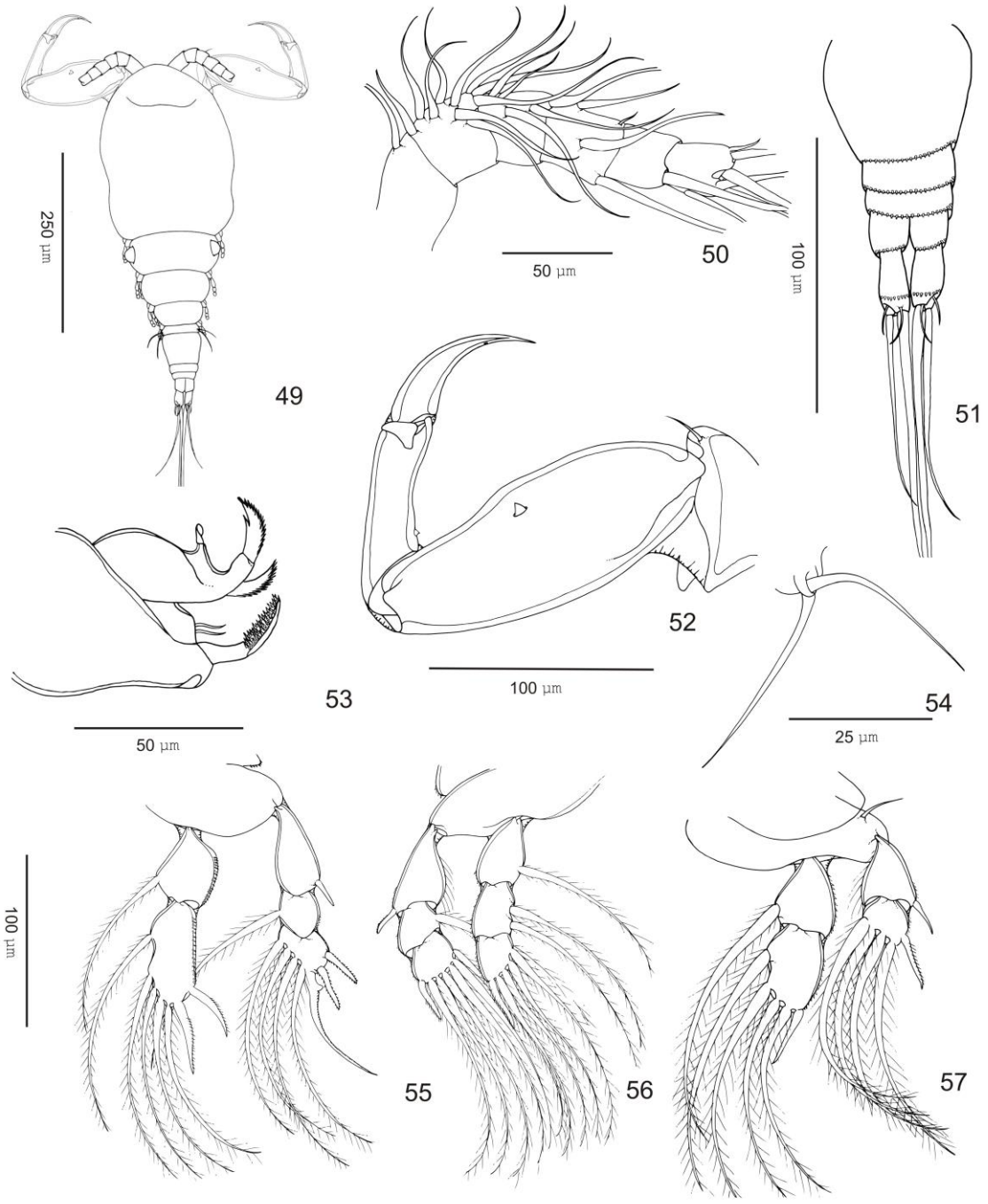
Table VIII: Spines and setal formula of the legs of *Ergasilus hypophthalmi.*

	Coxa	Basis	Exopod	Endopod
Leg I	0-0	0-0	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-4

*Pectinate seta

Taxonomic Summary
Host: *Hypophthalmus edentatus* Spix & Agassiz, 1829
Site: Gills filaments.
Locality: Furo do Catalão at the mouth of the Rio Negro, near Manaus, Amazonas, Brazil.
Male: Unkown.

REMARKS: Few differences were observed between the original description and the current redescription. One of these differences is the number of setae in leg V, which was originally described as reduced to a single seta. However, like most Neotropical species, leg V is reduced to two terminal setae. In legs II and III, the last segment of the exopod has six setae, contrasting the original description that reported only five. In leg IV, the first segment of endopod has a seta and the last segment a terminal spine, both were not originally observed.



Figures 49-57: *Ergasilus hypophthalmi*, adult female. (49) dorsal view; (50) antennule; (51) abdomen, caudal rami; (52) antenna; (53) mouth parts; (54) leg V; (55) leg I; (56) leg II=leg III; (57)leg IV. Scales: 49= 250 µm, 50, 53= 50 µm, 51, 52= 100 µm, 54= 25 µm, 55, 56, 57= 100 µm

Ergasilus jaraquensis Thatcher & Robertson, 1982

Figures 58-65

Redescription based on 16 adult female: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment shorter than first segment, presenting one sensillum; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 2-7-2-2-2-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle absent or not observed. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, lacking an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin,, or lacking spinules, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules on entire outer margin, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines curved, lacking spinules. **Legs II and III.** Basis lacking spinules, lacking an external seta. Exopod presenting 3 segments; first segment not pilose, lacking seta, lacking spinules, outer spine present, lacking spinules; second segment lacking spinules, with one seta, distal outer spine absent; third segment lacking spinules, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment with spinules distally on outer margin,

not pilose, with one seta; second segment with spinules distally on outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules distally on outer margin, with four setae, distal outer spine present. **Leg IV**. Basis lacking spinules, with an external seta. Exopod with 2 segments; first segment lacking spinules, pilose, lacking seta, distal outer spine absent; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; not pilose; second segment lacking spicules, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table IX. **Leg V** reduced to two distal setae, one longer than other. Genital segment lacking spinules, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac not observed.

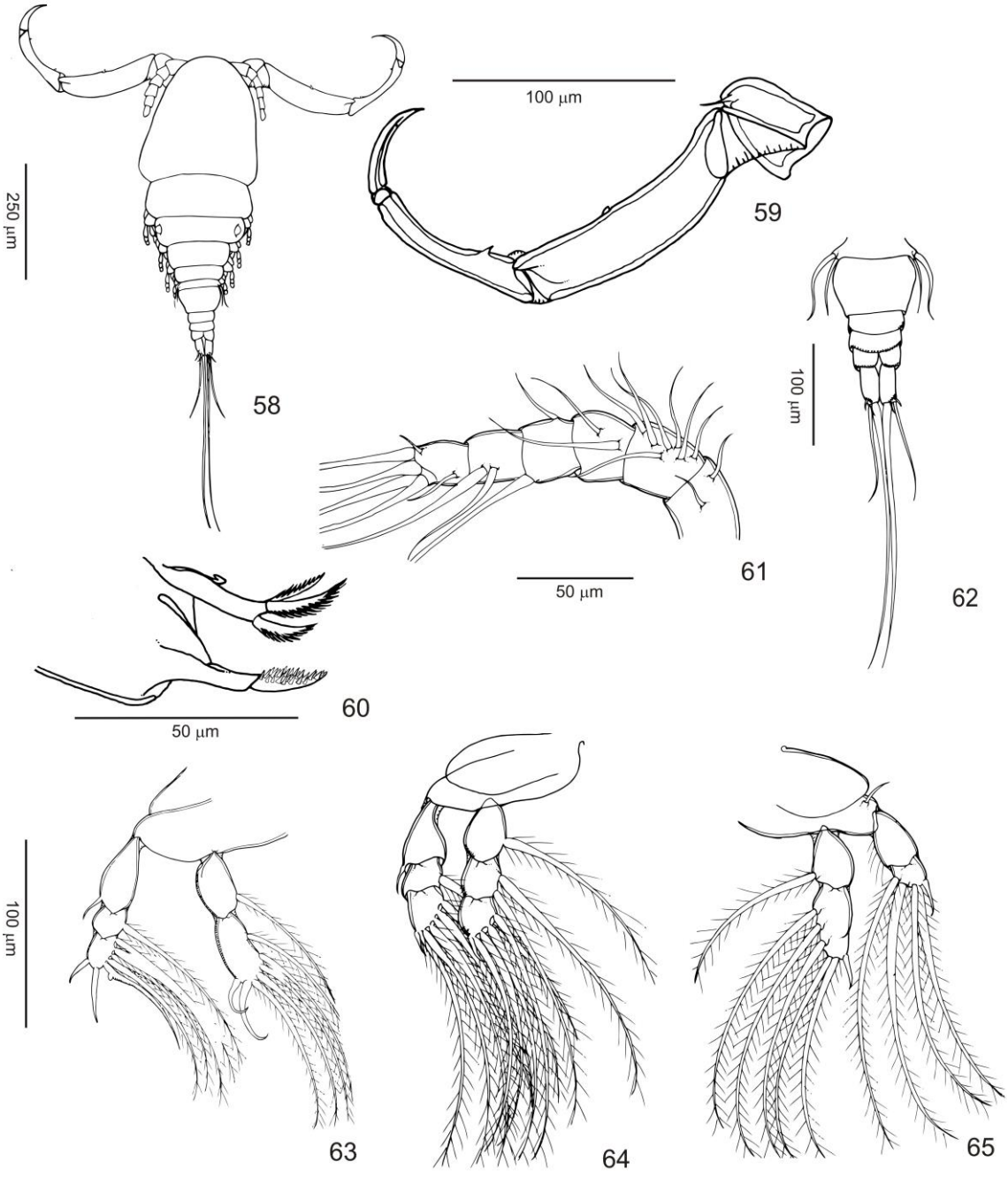
Table IX: Spines and setal formula of the legs of *Ergasilus jaraquensis.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-0	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Semaprochilodus insignis* (Jardine, 1841)
Site: Gills filaments.
Locality: Manaus,
Male: Unknown.

REMARKS: Unlike as firstly described, *E. jaraquensis* presents a sensilla at the first endopodal segment of the antenna, which is an important character to distinguish species. The anterior blade of the mandible was not previously reported by THATCHER & ROBERTSON (1982), details of rows of spines on the legs and abdominal segments were also not described.



Figures 58-65: ***Ergasilus jaraquensis*****, adult female. (58) dorsal view; (59) antenna; (60) mouth parts; (61) antennule; (62) abdomen, caudal rami; (63) leg I; (64) leg II=leg III; (65) leg IV. Scales: 58= 250 µm, 59, 62= 100 µm, 60, 61= 50 µm, 63, 64, 65= 100 µm.**

Ergasilus leporinidis Thatcher, 1981

Figures 66-73

Redescription based on 6 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous partially fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum larger than distal; third endopodal segment lacking seta or not observed; claw proximally recurved at about 90 degrees. Antenulle with 6 segments, aesthetascs two on fifth and three on the sixth segment, setal formula: 1-9-4-4-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates with spinules ventrally. **Leg I.** Basis with smooth margins, spinules present, with an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod lacking pectinate seta, with five pilose setae, with spinules on entire outer margin, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines curved, lacking spinules. **Legs II and III**. Basis lacking spinules, lacking an external seta. Exopod presenting 3 segments; first segment not pilose, lacking seta, lacking spinules, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present lacking spinules. Endopod with 3

segments; first segment with spinules distally on outer margin, not pilose, with one seta; second segment with spinules distally on outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, lacking an external seta. Exopod with 2 segments; first segment with spinules on entire outer margin, not pilose, lacking seta, distal outer spine present; second segment with spinules on entire outer margin, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; pilose; second segment lacking spicules, with five setae, distal outer spine absent. Number and distribution of spines and setae of legs I-IV are presented in Table X. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spines ventrally, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac short.

Table X: Spines and setal formula of the legs of *Ergasilus leporinidis.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-5	0-1; II-5
Leg II	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

Taxonomic Summary

Host: *Leporinus fasciatus* (Bloch, 1794)

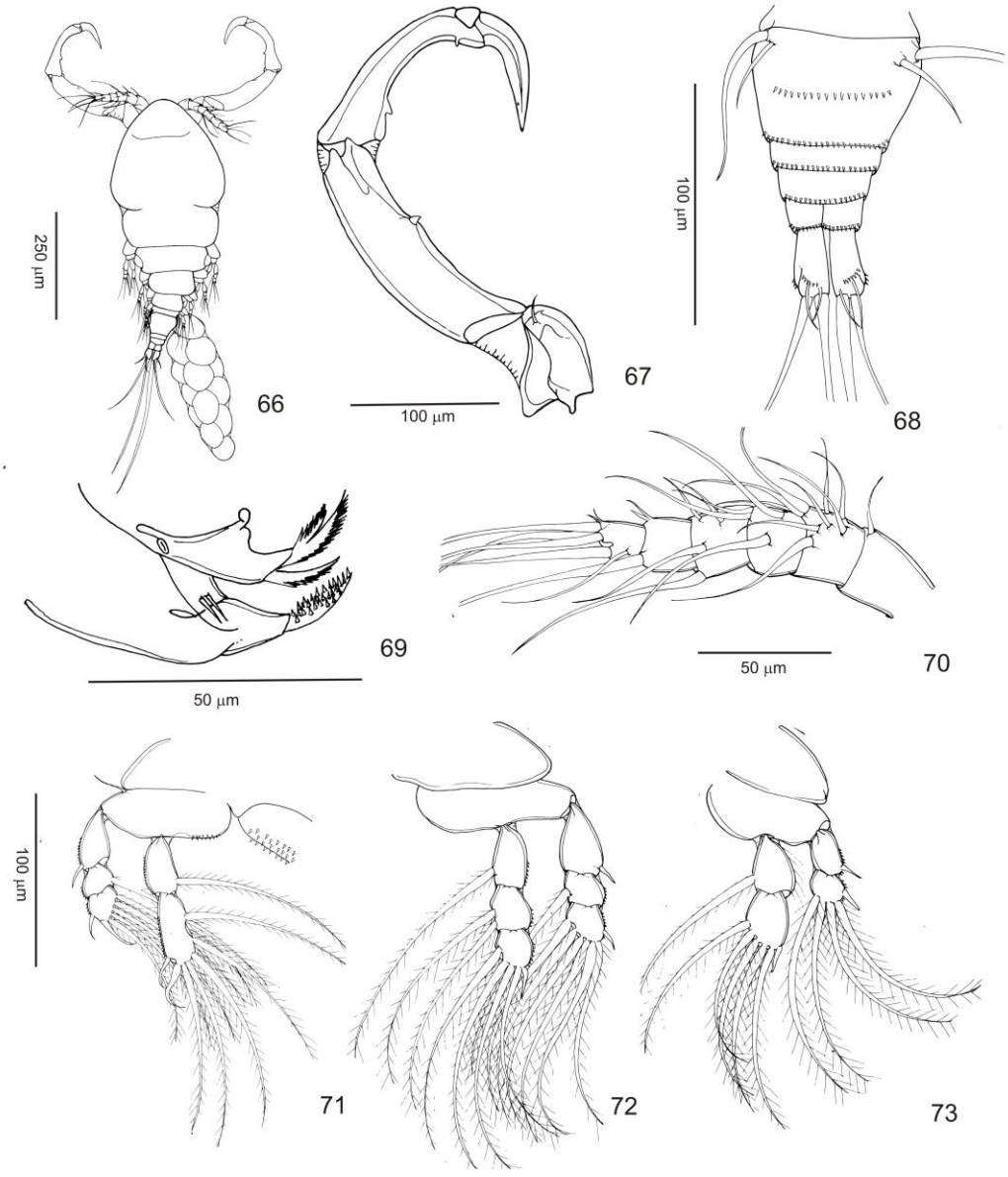
Site: Gills filaments.

Locality: Manaus, Amazonas, Brazil.

Male: Unknown.

REMARKS: Study of available specimens indicate some features that have not been reported/described in the original description: 1. The antennule has aesthetascs on the fifth and sixth segments; 2. The antenna presents sensilla on the median region of first endopodal segment; 3. The caudal rami supports a

pair of long setae, median setae and two more pairs of short setae. 4. The the last segment of endopod of leg I has two strong spines on posterior extremity and five pilose setae –THATCHER (1981) reported just one spine and six pilose setae; 5. In second pair of legs, the third segment of exopod has a spine and six setae (only five setae were reported in the original description); 6. The exopod of leg IV presents ornaments not previously seen, such as spinules and a spine postero-lateral in first segment.



Figures 66-73: *Ergasilus leporinidis*, adult female. (66) dorsal view; (67) antenna; (68) abdomen, caudal rami; (69) mouth parts; (70) antennule; (71) leg I; (72) leg II=leg III; (73) leg IV. Scales: 66= 250 µm, 67, 68= 100 µm, 69, 70= 50 µm, 71, 72, 73= 100 µm

Ergasilus pitalicus Thatcher, 1984

Figures 74-83

Redescription based on 6 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa lacking seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved, as long as first segment, presenting one sensillum; third endopodal segment lacking seta or not observed; claw proximally recurved at about 90 degrees. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-10-4-4-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla completely toothed, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates with distal row of spinules. **Leg I.** Basis with smooth margins, spinules present, with an external seta. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod lacking pectinate seta, with five pilose setae, with spinules on entire outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with four setae, spines straight, both ornate with spinules. **Legs II and III.** Basis ornate with spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules distally on outer margin, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present lacking spinules.

Endopod with 3 segments; first segment with spinules on entire outer margin, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis ornate with spinules, with an external seta. Coxa with spinules. Exopod with 2 segments; first segment with spinules distally on outer margin, pilose, lacking seta, distal outer spine absent; second segment with spinules distally on outer margin, with five setae, distal spine present. Endopod with 3 segments; first segment with spinules on entire outer margin, with one seta; not pilose; second segment with spinules distally on outer margin, with two setae, distal outer spine absent; third segment with spinules distally on outer margin, with three setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XI. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spines ventrally, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac elongate.

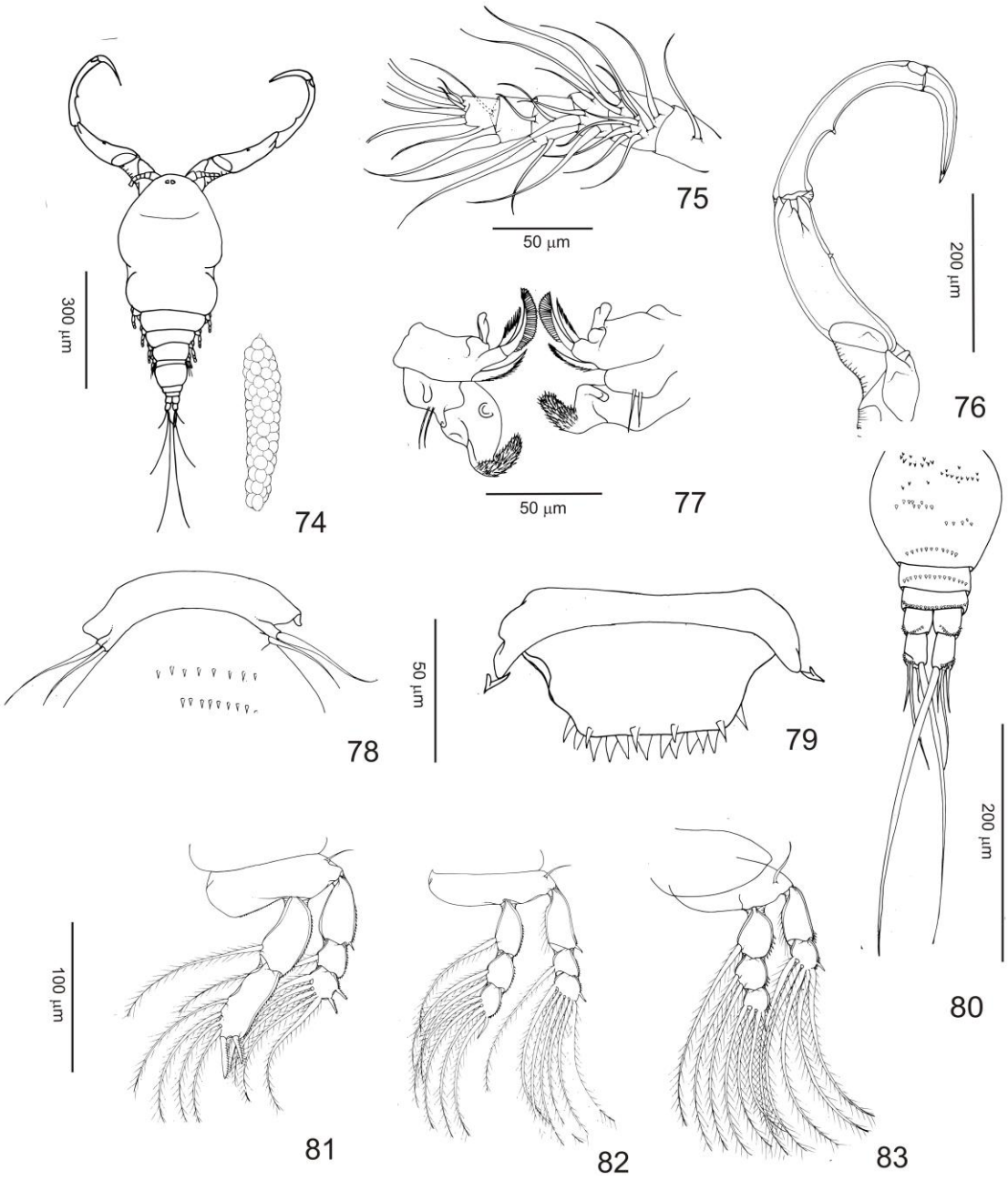
Table XI: Spines and setal formula of the legs of *Ergasilus pitalicus.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-5	0-1; II-4
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	0-0; I-5	0-1; 0-2; I-3

Taxonomic Summary
Host: *Cichlassoma sp.*
Site: Gills filaments.
Locality: Pital River, Departamento de Valle, Colombia.
Male: Unkown.

REMARKS: Few divergences from the original description were found. THATCHER (1984) described the antennule with first and second segments fused ventrally and dorsally separated. In this study, this fused portion was not visualized. The original description did not report the presence of aesthestacs

on fifth and sixth segments of antennule. The membrane between coxa and first endopodal segment was described as an inflated membrane not observed herein. In the swimming legs, ornamentations on the coxae are reported for the first time. Similar to *E. chelangulatus*, *E. pitalicus* has claw with a proximal bent at about 90 degrees. *Ergasilus pitalicus* differs significantly from other species in the neotropics by its large number of spines on the interpodal sclerites, ventral region of genital segments, abdominal segments, and caudal rami.



Figures 74-83: *Ergasilus pitalicus*, adult female. (74) dorsal view; (75) antennule; (76) antenna; (77) mouth parts; (78) genital segment and leg V, ventral view (79) sclerite; (80) abdomen, caudal rami; (81) leg I, (82) legII=leg III; (83)leg IV. Scales: 74= 250 µm, 75, 77= 50 µm, 76, 80= 200 µm, 78, 79= 50 µm, 81, 82, 83= 100 µm

Ergasilus salmini Thatcher & Brasil-Sato, 2008

Figures 84-91

Redescription based on adult 4 female: Cephalossome not inflated, lacking anterior projection. Cephalotorax less than twice the width, longer than 50% of body length, cephalotorax and first pedigerous partly fused. Antenna with coxa, three endopod segments and claw; coxa presenting a short distal setae, membrane between coxa and first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna larger than 3, cuticular elevation on sensillum of first endopodal segment absent, sensilum on first endopodal segment of antenna distal, internal margin of first endopodal segment of the antenna with spines; second segment curved and shorter than first segment, presenting two sensila; proximal sensillum strong; third endopodal segment with a single seta; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-9-5-5-2-7. Mouth parts comprising mandible, maxilla, maxillule, maxiliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulate seta on maxilla absent; two setal elements on maxilulle present. Interpodal sclerites lacking spines. **Leg I.** Basis with smooth margins, spinules absent, with posterior seta. Exopod with 3 segments; first segment of exopod lacking spinules, lacking seta, pilose, distal spine on outer margin present; second segment of exopod lacking spinules, with one seta, distal spine absent; third segment of exopod with one pectinated setae and four pilose setae, lacking spinules, two distal spines with spinules. Endopod with 2 segments; first segment lacking spinules, with one seta, inner margin pilose, second segment with spinules on entire outer margin, without rosette-like array of blunt spinules, with five setae, spines straight, only one with spinules. **Legs II and III similar.** Basis lacking spinules, with posterior seta. Coxa lacking spine. Exopod presenting 3 segments; first segment twice as long than wide, lacking seta, first segment pilose on inner side, with spinules distally on outer margin, distal spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal spine absent; third segment with spinules on entire outer

margin, with six setae, spine present and ornated with spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, without spines, pilose, with one seta; second segment with spinules on entire outer margin, not pilose, distal spine absent, with two setae; third segment with spinules on entire outer margin, distal spine present, with four setae. **Leg IV.** Basis lacking spinules, lacking posterior seta. Coxa lacking spine. Exopod with 2 segments; first segment lacking spinules, not pilose, distal spine present, lacking seta; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta, not pilose, second segment lacking spinules, distal spine present, with five setae. Number and distribution of spines and setae of legs I-IV are presented in Table XII. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensila. Abdominal segments 3 with spines on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac long.

Table XII: Spines and setal formula of the legs of *Ergasilus salmini.*

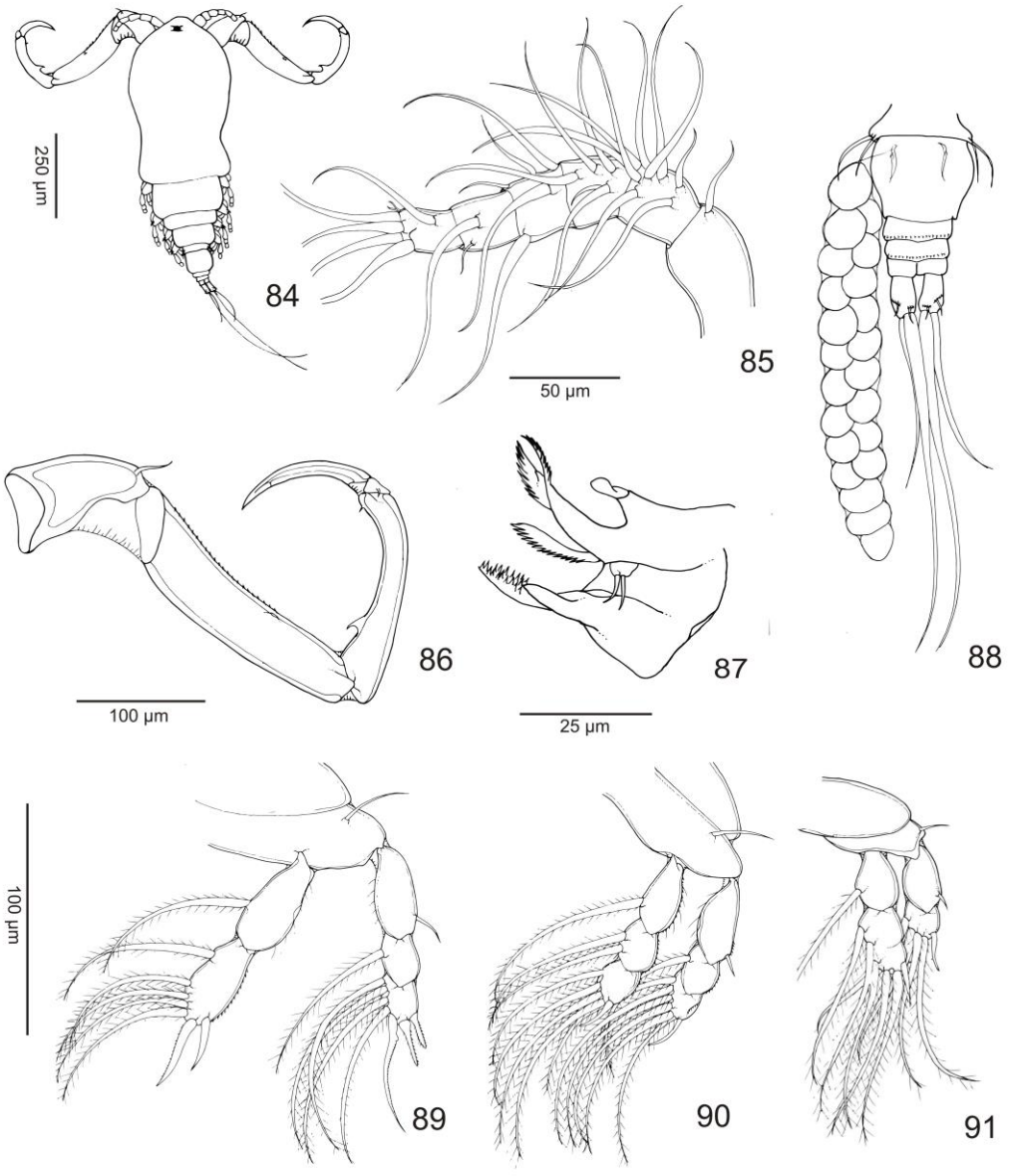
	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	I-0	I-0; 0-1; II*-4	0-1; II-5
Leg II	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	I-0	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Salminus franciscanus* Lima & Britski, 2007
Site: Gills filaments.
Locality: São Francisco River downstream from the Três Marias Dam, State of Minas Gerais, Brazil.
Male: Unknown.

REMARKS: Restudy of paratypes revealed some morphological differences from the original description. The cephalothorax and first pedigerous are partially fused (these segments were reported as unfused originally). Most

other discrepancies are related to the absence of sensilla, setae, spines and spinules reported here for the first time. Among the most significant diferences between the original description and the present redescription, are the following: **Antenna** – 1. Seta on the coxobasis; 2. sensillum on the first segment; 3. sensillum on the proximal region of the second endopodal segment; 4. Serrate internal margin of the second segment. **Antennule** – 5. With 21 setae and 2 aesthesthascs. **Legs** – 6. Number of elements (setae, spines); and 7. Leg IV two segmented, the last segment elongate, bearing five setae.



Figures 84-91: *Ergasilus salmini*, adult female. (84) dorsal view; (85) antennule; (86) antenna; (87) mouth parts; (88) abdomen, caudal rami and egg sac; (89) leg I; (90) leg II=leg III; (91) leg IV. Scales: 84= 250 µm, 85= 50 µm, 86, 88= 100 µm, 87= 25 µm, 89, 90, 91= 100 µm

Ergasilus sp. n. 2

Figures 92-99

Description based on 3 adult female: Cephalossome not inflated, lacking anterior projection. Cephalothorax less than twice the width, longer than 50% of body length, cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments and claw; coxa presenting a short distal setae, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spine; second segment curved and shorter than first segment, presenting one sensillum; third endopodal segment with a single seta; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-11-5-2-1-6. Mouth parts comprising mandible, maxilla, maxillule, maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed; basis of maxilla partially toothed on convex margin; spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal sclerites lacking spines. **Leg I.** Basis with smooth margins, spinules absent, with posterior setae. Exopod with 3 segments; first segment of exopod lacking spinules, lacking seta, not pilose, distal spine on outer margin present, the second segment of exopod with distal spinules on outer margin, with one seta, distal spine absent; third segment of exopod with one pectinate setae and four pilose setae, with spinules on entire outer margin, two distal spines with spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, with one seta, inner margin not pilose, second segment with spinules on entire outer margin, without rosette-like array of blunt spinules, with five setae, spines straight, lacking spinules. **Legs II and III similar**. Basis ornate with spinules. lacking posterior seta. Coxa lacking spine. Exopod presenting 3 segments; first segment less than twice the width, lacking seta, not pilose, lacking spinules, distal spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal spine absent; third segment with spinules on entire outer margin, with six setae, spine present lacking spinules. Endopod

with 3 segments; first segment with spinules on entire outer margin, without spines, not pilose, with one seta; second segment with spinules on entire outer margin, pilose, distal spine absent, with two setae; third segment with spinules on entire outer margin, distal spine present, with four setae. **Leg IV**. Basis lacking spinules. with posterior seta. Coxa lacking spine. Exopod with 2 segments; first segment lacking spinules, pilose, distal spine present, lacking seta; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment with spinules distally on outer margin, with one seta, pilose; second segment with spinules distally on outer margin, distal spine present, with five setae. Number and distribution of spines and setae of legs I-IV are presented in Table XIII. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spines on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac short.

Table XIII: Spines and setal formula of the legs of *Ergasilus sp.n. 2.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-0; II*-4	0-1; II-5
Leg II	0-0	0-0	I-0; 0-1; I-6	0-1; 0-2; I-3
Leg III	0-0	0-0	I-0; 0-1; I-6	0-1; 0-2; I-3
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary

Host: *Salminus brasiliensis* (Cuvier, 1816)

Site: Gills filaments.

Locality: Lagoa Dourada, Ponta Grossa, State of Paraná, Brazil

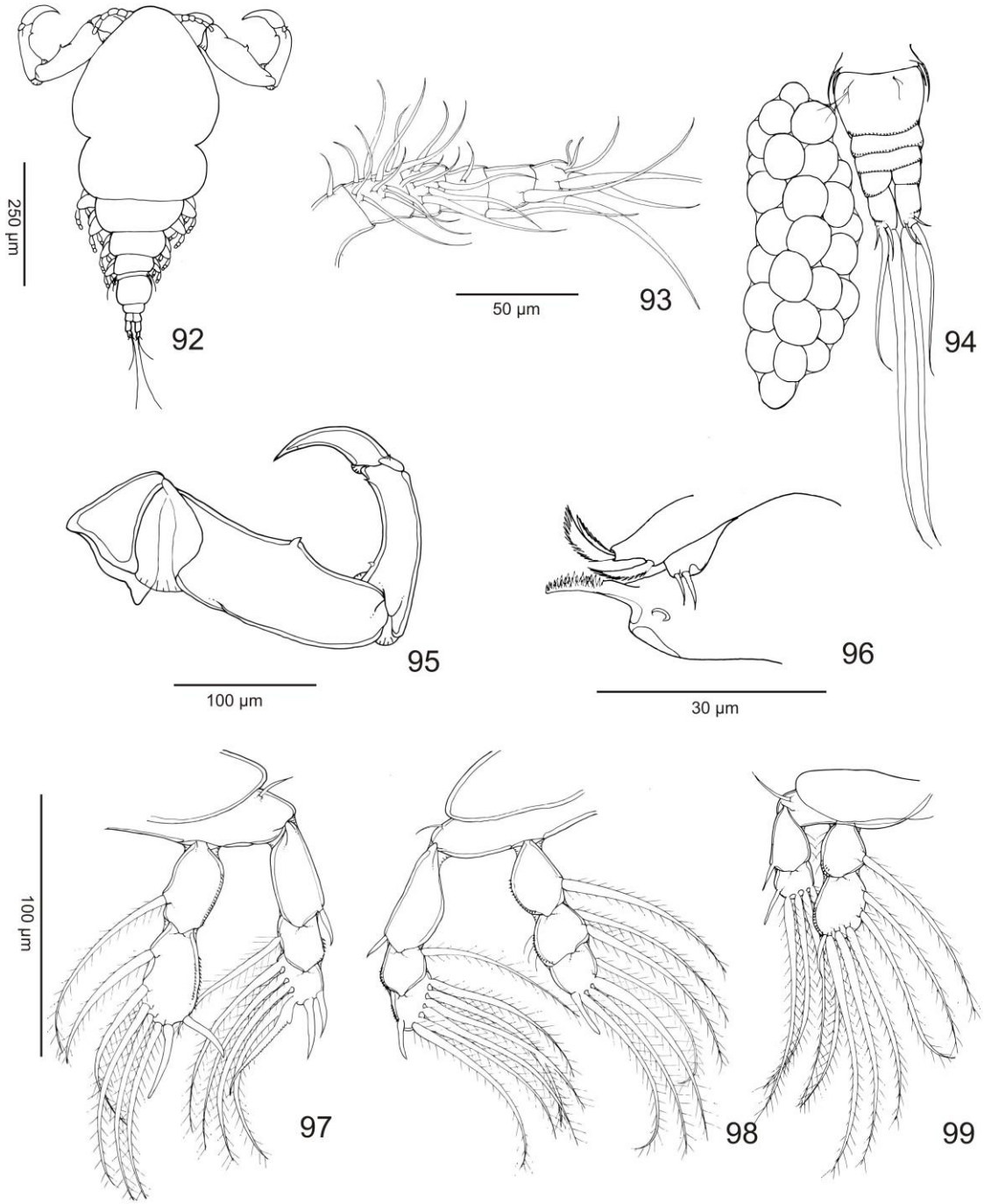
Male: Unknown.

Holotype: to be defined

Paratype: to be deposited

REMARKS: The new species differs from the only known species of *Ergasilus* from a *Salminus sp.* Host, *E. salmini*, by: 1. the morphology of the cephalothorax (inflated in the new species), 2. presenting more robust antena lacking spinules on inner margin of the first endopodal segment; 3. presenting a more robust egg sac, with multiple rows of eggs, and 4. Presenting the endopodite of leg IV composed of 2 segments while in *E. salmini* the second endopodal segment is partially segmented (incompletely fused ancestral segments 2-3 of the endopodite). As most species of genus, the species has pectinated seta on first pair of legs.

The new species is also similar to *E. turucuyus* by the relative size and shape of cephalothorax and morphology of the antena (both with first endopodal segment robust and sensillum near midlength); although *E. turucuyus* has the first endopodal segment of the antenna comparatively shorther than *E. lacusauratus sp. n.* However, these two species differ by the morphology of leg IV. *Ergasilus lacusauratus* presents a distal outer spine in first exopodal segment, not observed in *E. turucuyus.* Aesthetascs were observed only in the sixth segment of the antennule, while in most of species it is observed on the fifth and sixth segments. Further, *E. lacusauratus sp. n.* presents egg sac shorter and more robust than most of species of *Ergasilus* known from Brazil.



Figures 92-99: ***Ergasilus*** **sp. n. 2, adult female. (92) dorsal view; (93) antennule; (94) abdomen, caudal rami and egg sac; (95) antenna; (96) mouth parts; (97) leg I; (98) leg II=leg III; (99) leg IV. Scales: 92= 250 µm, 93= 50 µm, 94, 95= 100 µm, 96= 30 µm97, 98, 99= 100 µm**

Ergasilus sp. n. 3

Figures 100-107

Description based on 8 adult females: Cephalossome not inflated, lacking anterior projection. Cephalothorax less than twice the width, nearly 50% of body length, cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments and claw; coxa presenting a short distal setae, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna larger than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spine; second segment curved and shorter than first segment, presenting one sensillum; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 2-7-5-2-2-7. Mouth parts comprising mandible, maxilla, maxillule, maxilliped absent; mandible with anterior, median and posterior blades, median blade of mandible anteriorly toothed; basis of maxilla partially toothed on convex margin; spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal sclerites lacking spines**. Leg I.** Basis with conspicuous pointed projection at base of exopodite, spinules absent, with posterior setae. Exopod with 3 segments; first segment of exopod with spinules on entire outer margin, lacking seta, pilose, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal spine absent; third segment of exopod lacking pectinate seta, with five pilose setae, with spinules on entire outer margin, two distal spines lacking spinules. Endopod with 2 segments; first segment lacking spinules, with one seta, inner margin not pilose; second segment with spinules on entire outer margin, without rosette-like array of blunt spinules, with five setae, spines straight, lacking spinules. **Legs II and III similar**. Basis lacking spinules. with posterior seta. Coxa with a strong and curved spine. Exopod presenting 3 segments; first segment twice as long than wide, lacking seta, first segment pilose on the inner side, with spinules distally on outer margin, distal spine present, lacking spinules; second segment with spinules distally on outer margin, with one seta, distal spine absent; third segment with spinules distally

on outer margin, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment lacking spinules, with spines on the outer side, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, distal spine absent, with two setae; third segment with spinules on entire outer margin, distal spine present, with four setae. **Leg IV.** Basis lacking spinules. lacking posterior seta. Coxa with a strong and curved spine. Exopod with 2 segments; first segment lacking spinules, not pilose, distal spine present, lacking seta; second segment lacking spinules, with five setae, distal spine present. Endopod with 3 segments; first segment with spinules on entire outer margin, with one seta, not pilose; second segment with spinules distally on outer margin, distal spine absent, with two setae; third segment with spinules distally on outer margin, with three setae, distal spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XIV. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spines on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac long.

Table XIV: Spines and setal formula of the legs of *Ergasilus sp. n. 3.*

	Coxo	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-5	0-1; II-5
Leg II	I-0	0-0	I-0; 0-1; I-6	0-1; 0-2; I-4
Leg III	I-0	0-0	I-0; 0-1; I-6	0-1; 0-2; I-4
Leg IV	I-0	0-0	I-0; I-5	0-1; 0-2; I-3

Taxonomic Summary

Host: *Salminus franciscanus* Lima & Britski, 2007

Site: Gills filaments.

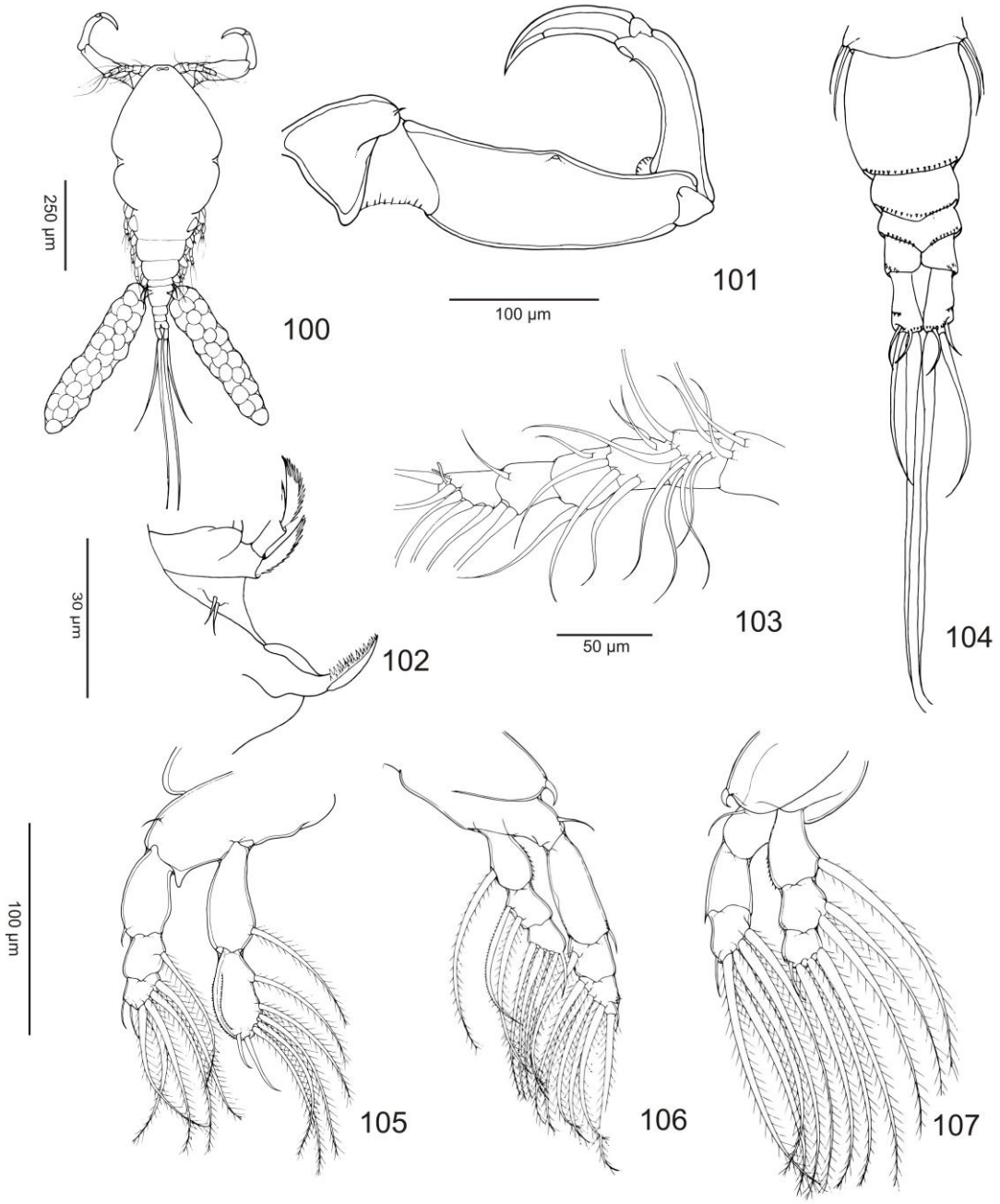
Locality: São Francisco River.

Male: Unknown.

Holotype: to be defined

Paratype: to be deposited

REMARKS: Similar to *E. coatiarus*, *E. iheringi* TIDD, 1942, *E. leporinidis*, and *E. pitalicus*, the new species does not present a pinnate seta in the exopod of the first pair of legs, common to most species of the genus in the neotropics. However, The new species can be easily differentiated from these and all other neotropical species of *Ergasilus* by presenting a robust and curved spine on coxa on legs II, III and IV.



Figures 100-107: *Ergasilus* sp. n.3, adult female. (100) dorsal view; (101) antenna; (102) mouth parts; (103) antennule; (104) abdomen and caudal rami; (105) leg I; (106) leg II=leg III; (107) leg IV. Scales: 100= 250 µm, 101, 104= 100 µm, 102= 30 µm, 103= 50 µm, 105, 106, 107= 100 µm.

Ergasilus thatcheri Engers, Boeger & Brandão, 2000

Taxonomic Summary
Host: *Rhamdia quelen* (Quoy & Gaimard, 1824)
Site: Gills filaments.
Locality: Barragem do Canapé, Cachoeira do Sul, Rio Grande do Sul, Brazil.
Male: Unknown.

Specimens studied: five specimens from PCVT.

REMARKS: The original description is correct; no discrepancies were found.

Ergasilus triangularis Malta, 1994

Figures 108-115

Redescription based on 10 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous partially fused. Antenna with coxa, three endopod segments, claw; coxa lacking seta, membrane between coxa and first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-7-3-3-1-3. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod lacking spinules, pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with

spinules on entire outer margin, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines long, one curved, lacking spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, lacking spinules, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, with an external seta. Exopod with 2 segments; first segment lacking spinules, not pilose, lacking seta, distal outer spine present; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; not pilose; second segment lacking spicules, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XV. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules absent. Egg sac short.

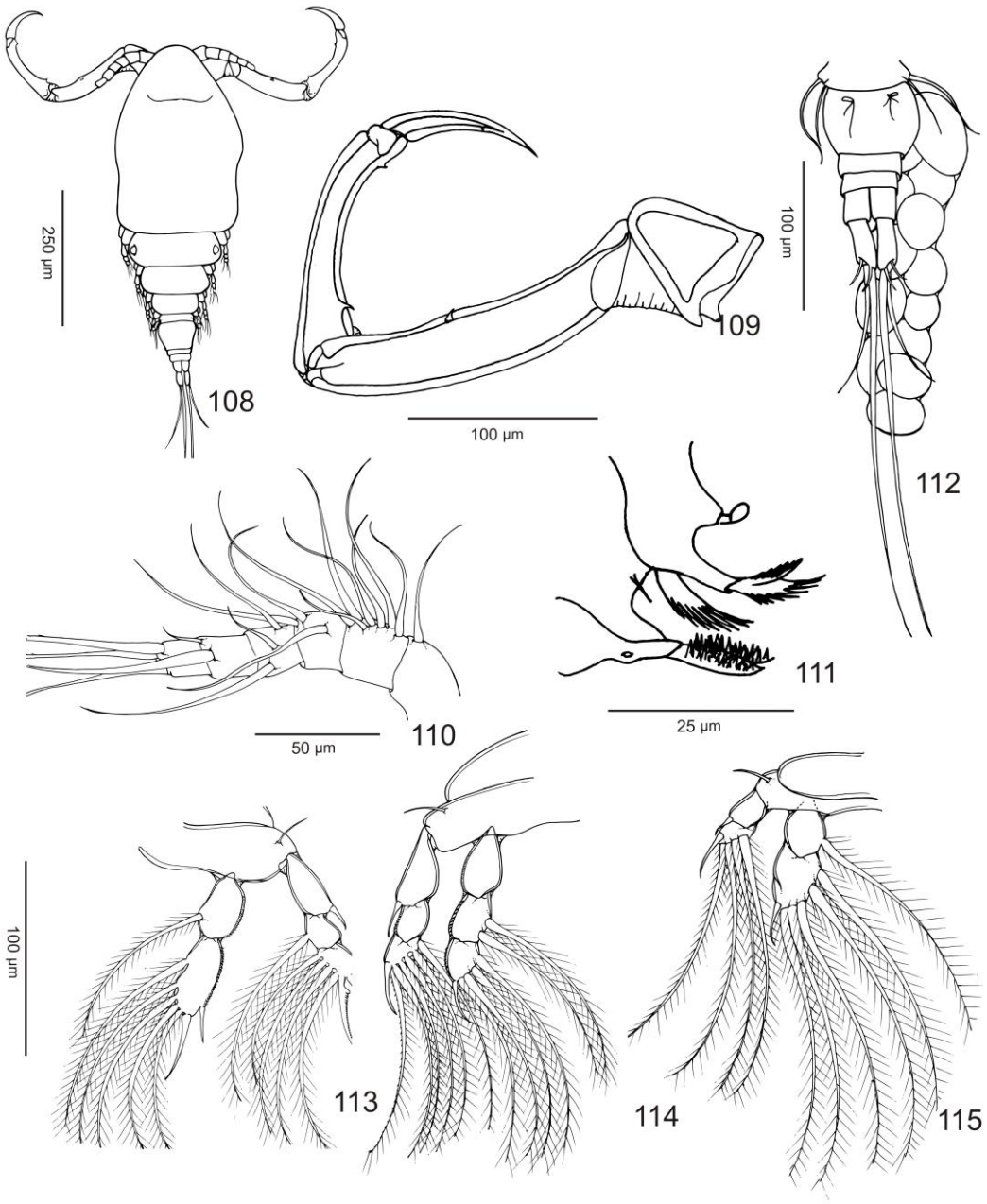
Table XV: Spines and setal formula of the legs of *Ergasilus triangularis.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-0; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-0; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Laemolyta taeniata* (Kner, 1858)
Site: Gills filaments.
Locality: Jamari River, state of Rondônia, Brazil.
Male: Unkown.

REMARKS: Few differences were observed between the original and present redescription. Some estructures were not observed by MALTA (1994) such as the distal sensila on second endopodal segment of antenna, spinules on the outer margin of legs II and III, and external seta on basis of all leg. The major morphological differences between this and the original description are the presence of six setae on the third exopodal segment on legs II and II (described with five setae), as most of species of the genus.



Figures 108-115: *Ergasilus triangularis*, adult female. (108) dorsal view; (109) antenna; (110) antennule; (111) mouth parts; (112) abdomen and caudal rami; (113) leg I; (114) leg II=leg III; (115) leg IV. Scales: 108= 250 µm, 109, 112= 100 µm, 110= 50 µm, 111= 25 µm, 112, 114, 115= 100 µm

Ergasilus trygonophilus Domingues & Marques, 2010

Taxonomic Summary
Host: *Potamotrygon spp; Plesiotrygon iwamae* (Rosa, Castello & Thorson, 1987)
Site: Gills filaments.
Locality: Marajó Bay, Municipality Colares, state of Pará, Brazil
Male: Unknown.

Specimens studied: Three specimens from PCVT

REMARKS: In general, the original description is adequate. However, leg V was not reported in the currenty study. In the studied specimens, leg V is composed by two setae.

Ergasilus turucuyus Malta & Varella, 1996

Figures 116-123

Redescription based on 14 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, nearly 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment present, sensillum on first endopodal segment of antenna near mid length, internal margin of first endopodal segment of the antenna lacking spinules; second segment shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-10-2-2-1-4. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules**. Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod with spinules distally on outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with distal spinules on outer margin,

with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules on entire outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment lacking spinules, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines straight, both ornate with spinules**. Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment pilose on the inner side, lacking seta, with spinules distally on outer margin, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment lacking spinules, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment lacking spinules, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis lacking spinules, lacking an external seta. Exopod with 2 segments; first segment with spinules distally on outer margin, not pilose, lacking seta, distal outer spine absent; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; pilose; second segment lacking spicules, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XVI. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules present. Egg sac not observed.

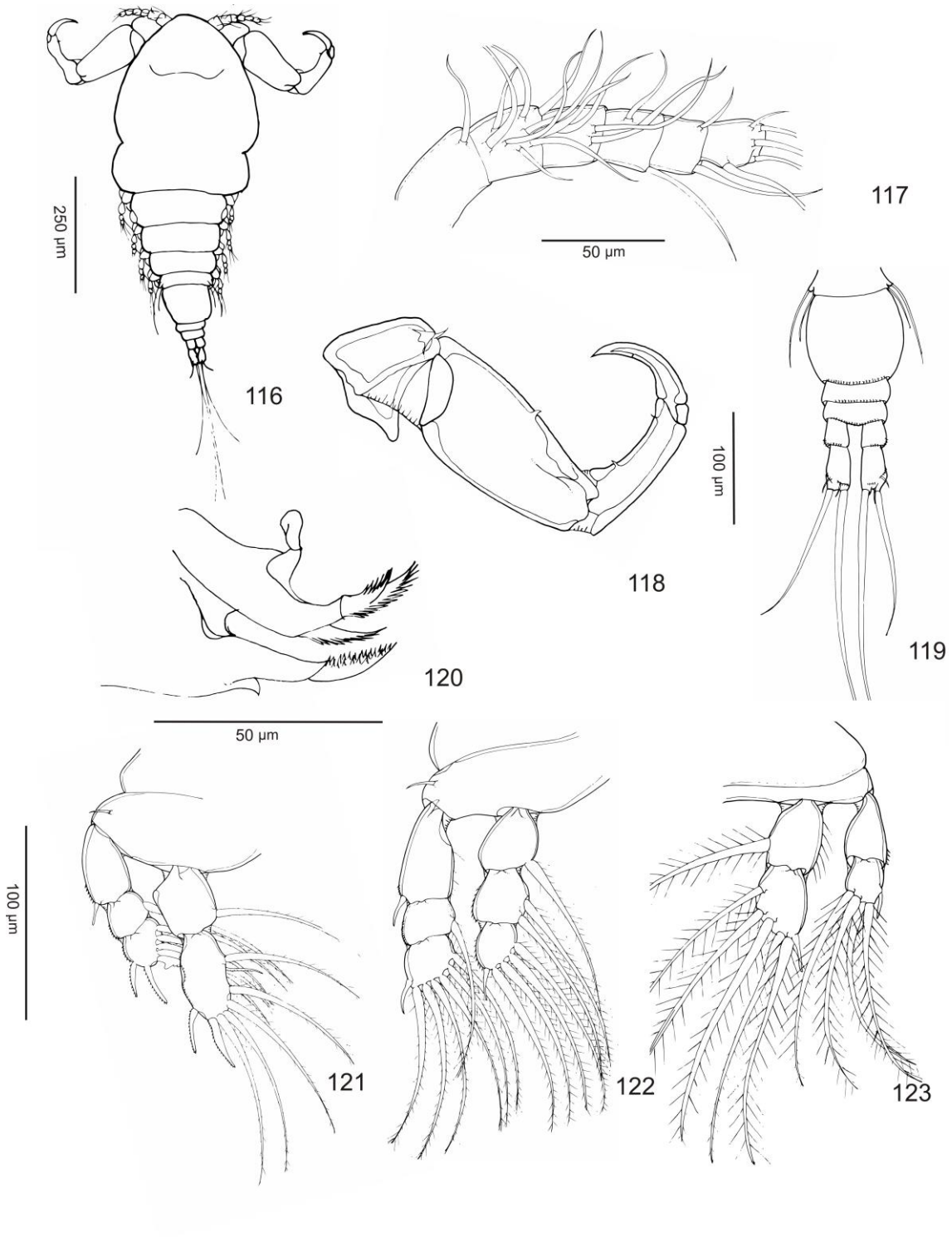
Table XVI: Spines and setal formula of the legs of *Ergasilus turucuyus.*

	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg I	0-0	0-0	0-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Acestrorhyncus falcatus* (Bloch, 1794)
Site: Gills filaments.
Locality: Pacaás Novos River, near Guajará-Mirim, State of Rondônia, Brazil
Male: Unkown.

REMARKS: An important character for distinguishing this species from all other species of the genus from Brazil is the presence of a sensillum on the second endopodal segment of the antenna. This structure, however, is so small that is hard visualized. In the original description it was not reported. The same happened with a second sensillum on distal region of second endopodal segment.



Figures 116-123: *Ergasilus turucuyus*, adult female. (116) dorsal view; (117) antennule; (118) antenna; (119) abdomen and caudal rami; (120) mouth parts; (121) leg I; (122) leg II=leg III; (123) leg IV. Scales: 116= 250 µm, 117, 120= 50 µm, 118, 119, 121, 122, 123= 100 µm

Ergasilus urupaensis Malta, 1993

Figures 124-131

Redescription based on 7 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, shorter than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna greater than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna sub-distal, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs one on fifth and three on sixth segment, setal formula: 1-9-5-4-2-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I**. Basis with smooth margins, spinules present, with external seta. Exopod with 3 segments; first segment of exopod with spinules distally on outer margin, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod with spinules on entire outer margin, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules on entire outer margin, two distal outer spines lacking spinules. Endopod with 2 segments; first segment with spinules on entire outer margin, inner margin not pilose, with one seta; second segment with spinules on entire outer margin, with five setae, spines straight, both ornate with spinules. **Legs II and III.** Basis lacking spinules, with external seta. Coxa with spinules. Exopod presenting 3 segments; first segment pilose on inner side, lacking seta, with spinules distally on outer margin, outer spine present, lacking spinules; second segment with spinules on entire outer margin, with one seta, distal outer spine absent; third segment with spinules on entire outer margin, with five setae, spine present

lacking spinules. Endopod with 3 segments; first segment with spinules on entire outer margin, not pilose, with one seta; second segment with spinules on entire outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules on entire outer margin, with four setae, distal outer spine present. **Leg IV.** Basis ornate with spinules, with external seta. Exopod with 2 segments; first segment with spinules on entire outer margin, not pilose, lacking seta, distal outer spine present; second segment with spinules on entire outer margin, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; not pilose; second segment lacking spicules, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XVII. **Leg V** reduced to two distal setae, one longer than other. Genital segment ornate with spinules on posterior margin, lacking lateral sensilla. Abdominal segments 3 with spinules on entire posterior margin. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one medium and three short setae, spinules present. Egg sac not observed.

Table XVII: Spines and setal formula of the legs of *Ergasilus urupaensis.*

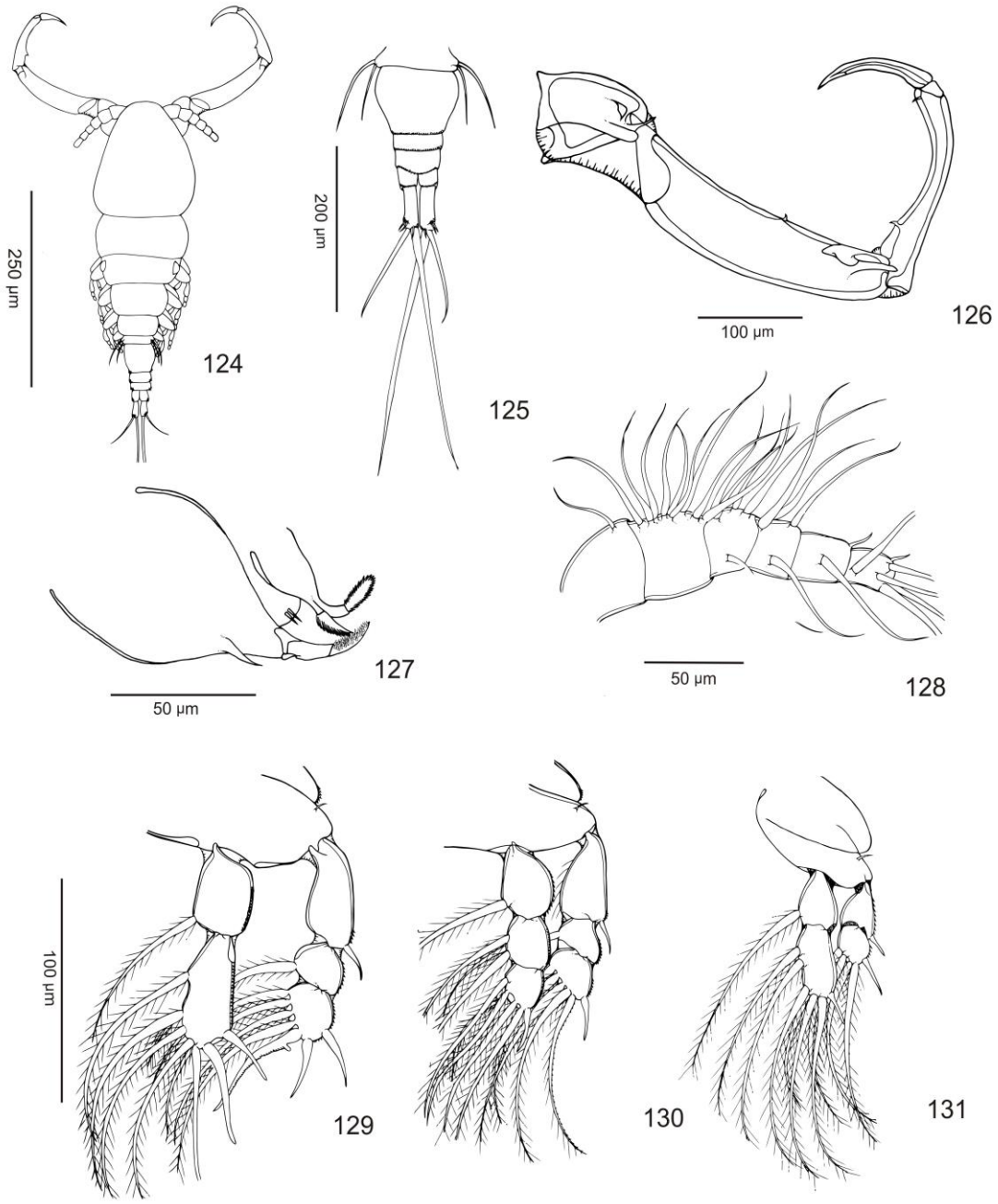
	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-1	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Prochilodus nigricans* Agassiz, 1829
Site: Gills filaments.
Locality: Urupá River, near Jiparaná City, State of Rondônia, Brazil.
Male: Unknown.

REMARKS: Some differences between the original and the present redescription were observed: 1) Coxa of the antenna is incomplete and presents a distal seta; 2) The sensillum on median region of first endopodal segment was not observed by MALTA (1993), as the sensilla on the distal region

of second endopodal segment; 3) Caudal rami with three short setae, instead of two as in the original description. 4) Abdominal segments with ventral row of spines on the distal margin is reported for the first time.



Figures 124-131: *Ergasilus urupaensis*, adult female. (124) dorsal view; (125) abdomen and caudal rami; (126) antenna; (127) mouth parts; (128) antennule; (129) leg I; (130) leg II=leg III; (131) leg IV. Scales: 124= 250 µm, 125= 200 µm, 126= 100 µm, 127, 128= 50 µm, 129, 130, 131= 100 µm

Ergasilus yumaricus Malta e Varella, 1995

Figures 132-140

Redescription based on 21 adult females: Cephalossome not inflated, cephalothorax length less than twice the width, longer than 50% of body length; cephalothorax and first pedigerous not fused. Antenna with coxa, three endopod segments, claw; coxa presenting a short distal seta, membrane between coxa and the first segment of endopod not inflated; length/width ratio of first endopodal segment of antenna smaller than 3, cuticular elevation on sensillum of first endopodal segment absent, sensillum on first endopodal segment of antenna sub-distal, internal margin of first endopodal segment of the antenna lacking spinules; second segment curved and shorter than first segment, presenting two sensilla; proximal sensillum small; third endopodal segment lacking seta or not observed; claw evenly curved. Antenulle with 6 segments, aesthetascs present on fifth and sixth segment, setal formula: 1-7-5-4-1-5. Mouth parts comprising mandible, maxilla, maxillule; maxilliped absent; mandible with anterior, median, posterior blades; median blade of mandible anteriorly toothed, basis of maxilla partially toothed on convex margin, spinulose seta on maxilla absent; two setal elements on maxilulle present. Interpodal plates lacking spinules. **Leg I.** Basis with smooth margins, spinules absent, with an external seta. Exopod with 3 segments; first segment of exopod lacking spinules, not pilose, lacking seta, distal spine on outer margin present; second segment of exopod lacking spinules, with one seta, distal outer spine absent; third segment of exopod with one pectinate seta and four pilose setae, with spinules distally on outer margin, two distal outer spines with spinules. Endopod with 2 segments; first segment lacking spinules, inner margin not pilose, with one seta; second segment with distal spinules on outer margin, with five setae, spines curved, both ornate with spinules. **Legs II and III.** Basis lacking spinules, with an external seta. Exopod presenting 3 segments; first segment not pilose, lacking seta, with spinules distally on outer margin, outer spine present, lacking spinules; second segment with spinules distally on outer margin, with one seta, distal outer spine absent; third segment with spinules distally on outer margin, with six setae, spine present lacking spinules. Endopod with 3 segments; first segment with spinules distally on outer margin, not pilose, with one seta;

second segment with spinules distally on outer margin, not pilose, with two setae, distal outer spine absent; third segment with spinules distally on outer margin, with four setae, distal outer spine present. **Leg IV**. Basis lacking spinules, lacking an external seta. Exopod with 2 segments; first segment lacking spinules, not pilose, lacking seta, distal outer spine present; second segment lacking spinules, with four setae, distal spine present. Endopod with 2 segments; first segment lacking spinules, with one seta; not pilose; second segment lacking spicules, with five setae, distal outer spine present. Number and distribution of spines and setae of legs I-IV are presented in Table XVIII. **Leg V** reduced to two distal setae, one longer than other. Genital segment lacking spinules, lacking lateral sensilla. Abdominal segments 3 lacking spinules. Caudal rami longer than wide, lacking setae on inner margin, presenting one long, one median and two short setae, spinules absent. Egg sac short.

Table XVIII: Spines and setal formula of the legs of *Ergasilus yumaricus.*

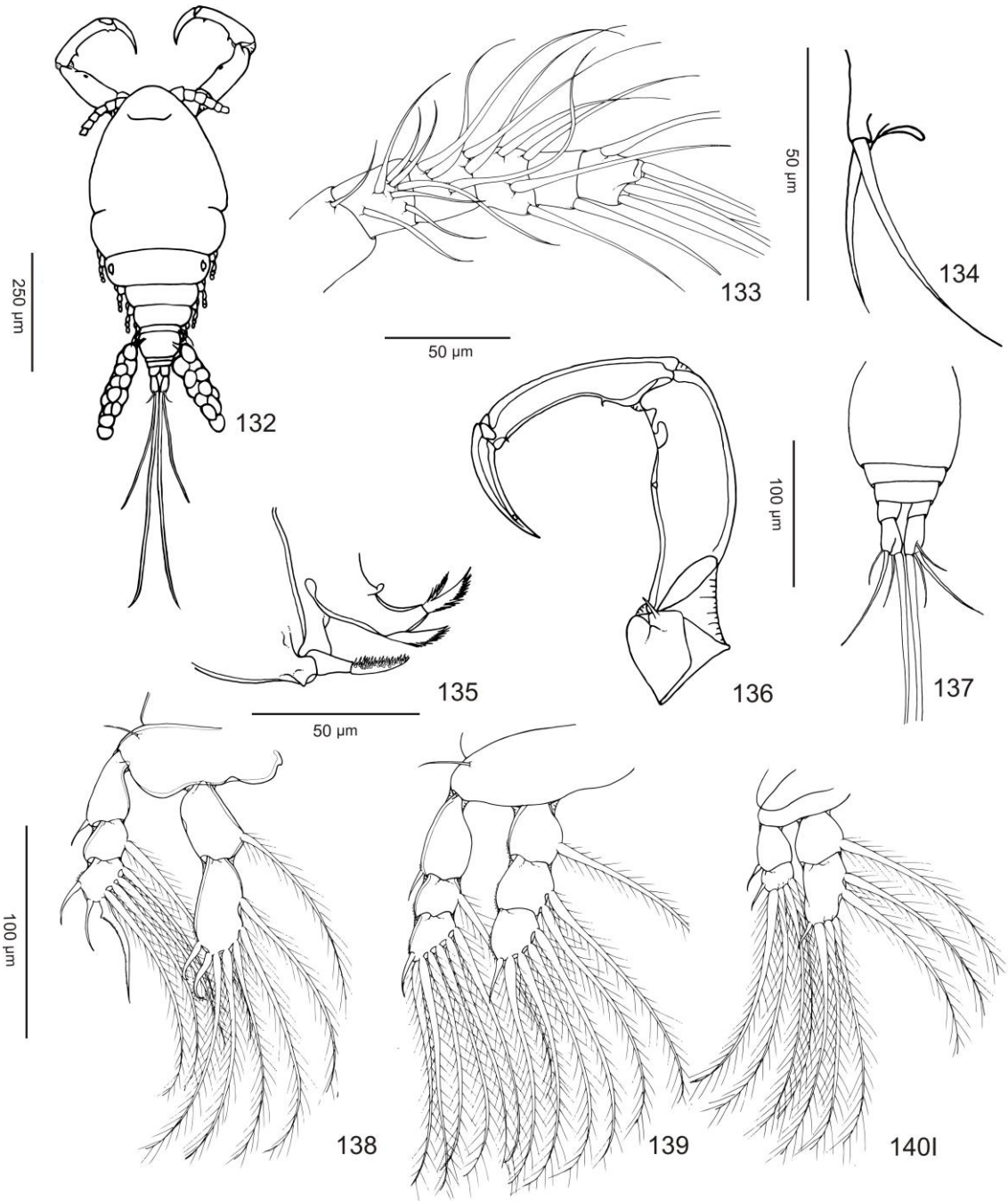
	Coxa	**Basis**	**Exopod**	**Endopod**
Leg I	0-0	0-1	I-0; 0-1; II-4*	0-1; II-5
Leg II	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg III	0-0	0-1	I-0; 0-1; I-6	0-1, 0-2; I-4
Leg IV	0-0	0-0	I-0; I-4	0-1; I-5

*Pectinate seta

Taxonomic Summary
Host: *Pygocentrus nattereri* Kner, 1860
Site: Gills filaments.
Locality: Guaporé River, near Pimenteiras City, State of Rondônia, Brazil
Male: Unknown.

REMARKS: Some discrepancies between the description by MALTA & VARELLA (1995) and the current redescription have been identified. The original description did not report the following features: 1) Anterior blade of the mandible; 2) Postero-lateral spine at the first segment of exopod of leg I has a serrated membrane. Further, the seta reported by MALTA & VARELLA (1995) on

the first segment of exopod of second and third pairs of legs was not observed on any of the 21 specimens studied.



Figures 132-140: *Ergasilus yumaricus*, adult female. (132) dorsal view; (133) antennule; (134) leg V (135) mouth parts; (136) antenna; (F) abdomen, caudal rami; (138) leg I; (139) leg II=leg III; (140) leg IV. Scales: 132= 250 µm, 133, 134, 135= 50 µm, 136, 137, 138, 139, 140= 100 µm

Table XIX: character matrix and states of characters used in cladistc analysis of *Ergasilus*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Ergasilus bryconis	1	2	2	1	0	1	2	0	1	2	1	0	1	0	1	0	0	0	0	3	2	1	1	1	2	2	0	0	2	2	0	0
Ergasilus callophysus	1	2	1	1	0	1	2	0	1	2	2	0	0	2	1	0	0	0	0	3	1	1	0	1	1	1	0	0	1	2	0	0
Ergasilus chelangulatus	0	2	0	1	0	0	1	0	1	2	2	0	0	1	1	0	0	0	0	3	1	1	1	2	2	2	0	0	1	2	0	0
Ergasilus coatiarus	1	2	2	1	2	1	1	0	1	1	1	0	1	0	1	0	1	1	0	3	4	2	1	2	1	2	0	0	0	2	0	0
Ergasilus colomesus	1	2	0	0	1	1	2	0	0	1	1	0	1	1	1	0	1	1	0	2	1	0	1	0	1	0	1	1	1	0	0	3
Ergasilus holobryconis	1	2	2	1	1	0	2	0	0	1	1	1	1	0	1	0	0	1	0	3	1	3	0	2	1	2	0	0	1	2	0	0
Ergasilis hydrolycus	1	0	2	1	1	0	1	0	2	2	1	0	1	0	1	0	0	0	0	3	1	0	1	2	1	2	0	0	1	2	1	0
Ergasilus hypophthalmi	1	0	1	1	1	0	2	0	0	2	1	0	1	0	0	0	0	0	0	3	2	1	0	1	2	2	0	0	2	2	0	0
Ergasilus jaraquensis	1	2	2	1	0	0	2	0	0	2	1	0	1	0	1	0	0	1	0	3	2	0	1	2	1	0	0	0	1	2	0	0
Ergasilus leporinidis	1	2	1	1	0	1	2	0	1	2	2	0	0	2	1	0	1	1	0	3	2	0	1	2	1	2	0	0	1	2	0	0
Ergasilus pitalicus	1	2	2	0	0	1	2	0	2	1	1	0	0	1	1	0	1	0	0	3	1	1	0	2	1	0	1	1	1	0	0	0
Ergasilus salmini	1	2	1	1	0	0	1	1	1	2	2	1	1	0	1	0	0	0	0	3	1	2	1	2	1	2	0	0	1	2	0	0
Ergasilus n. sp 2	1	2	2	1	1	1	2	0	1	2	1	0	1	0	1	0	0	0	0	3	1	0	0	2	1	2	0	0	1	2	0	0
Ergasilus n. sp 3	1	0	2	1	0	0	2	0	1	0	0	0	1	0	1	0	1	1	0	3	4	0	0	2	1	0	0	1	0	0	0	0
Ergasilus thatcheri	1	0	1	1	0	0	1	1	1	2	1	1	1	2	1	0	0	0	0	3	1	1	1	2	2	2	0	0	2	2	0	0
Ergasilus triangularis	1	2	1	0	0	0	2	0	1	2	1	0	1	0	1	0	0	1	0	3	1	3	0	2	1	2	0	0	1	2	0	0
Ergasilus trygonophilus	0	2	1	0	0	1	2	0	2	2	1	1	1	0	1	0	0	3	0	3	2	4	0	2	3	1	1	1	0	0	0	0
Ergasilus turucuyus	1	0	2	1	1	1	2	0	0	2	1	0	1	0	1	0	0	0	0	3	1	1	1	2	1	0	0	0	1	2	0	0
Ergasilus urupaensis	1	1	2	1	0	0	2	0	1	2	3	0	1	0	1	0	0	0	0	3	1	1	1	2	1	2	0	0	1	2	0	2
Ergasilus yumaricus	1	2	2	1	1	0	1	0	1	2	1	0	1	0	1	0	0	0	0	3	2	1	1	2	1	2	0	0	1	2	0	0
Ergasilus bahiensis	1	2	2	0	1	1	2	0	0	2	1	0	1	1	1	1	1	0	1	0	0	5	1	2	0	2	0	1	0	0	2	1
Ergasilus atafonensis	1	0	2	0	2	1	1	0	2	2	1	1	1	2	1	1	1	0	1	0	0	5	1	2	0	2	1	1	0	0	2	4
Ergasilus caraguatatubensis	1	2	0	0	1	1	1	0	2	2	1	0	1	1	1	0	1	0	0	3	1	1	1	2	1	2	0	1	0	0	1	1
Ergasilus from dragon fish	1	2	1	1	2	0	2	0	0	2	1	1	1	0	1	1	1	1	1	0	0	5	1	2	0	2	1	1	0	0	2	1

Phylogenetic Analysis

The tree obtained from phylogenetic analysis using successive weigth is shown in Figure 27 (CI=0.64, tree length = 59.27). According to the resulting topology, the assembly of neotropical species of *Ergasilus* is not monophyletic. *Ergasilus colomesus* is closely related to marine species of the genus (the outgroup of the analysis) while all remaining freshwater species compose a monophyletic group. Bremmer support was considered almost null for most of the subordinate clades, thus we do not present them.

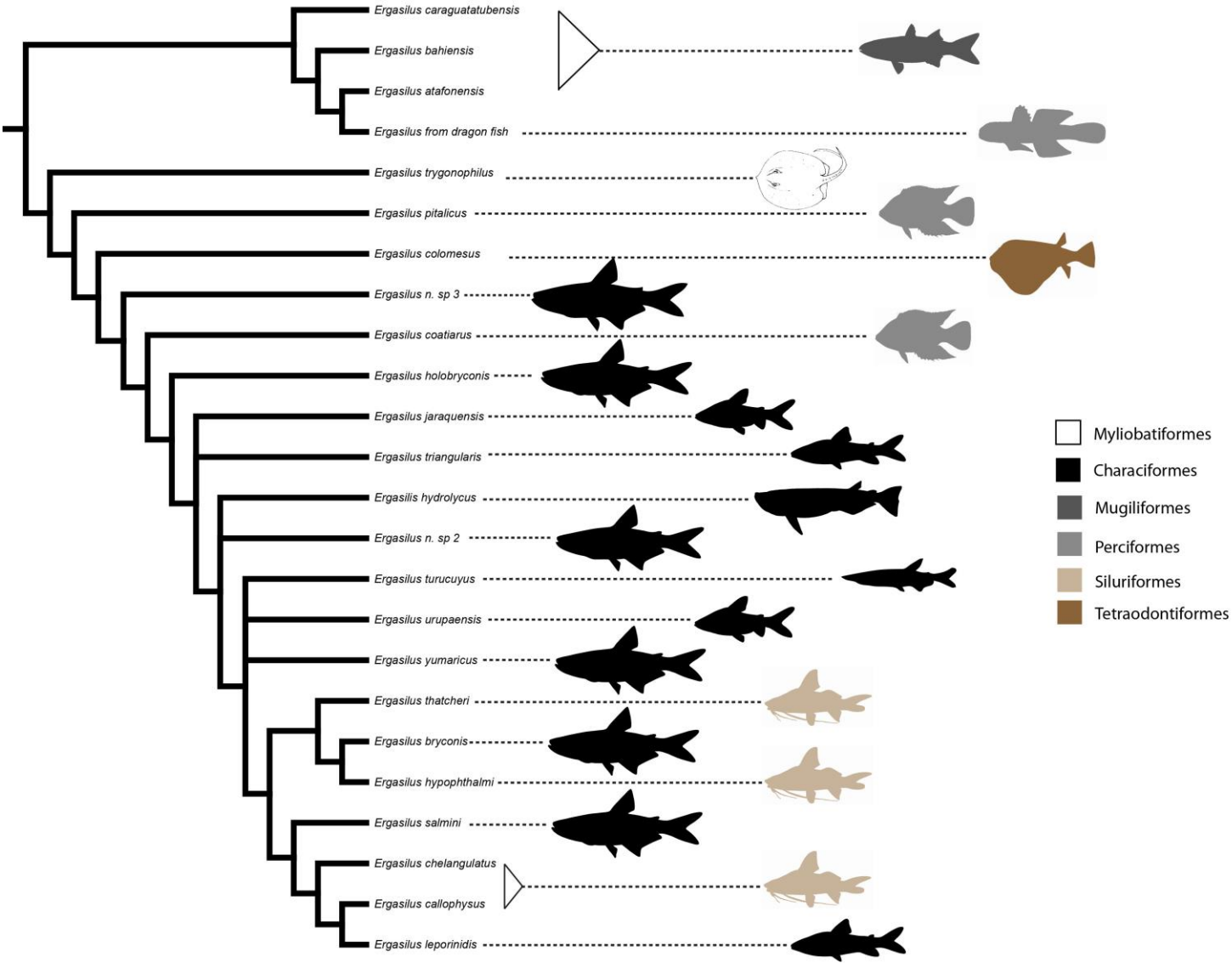


Figure 141: Phylogenetic hypothesis based on morphologic data (33 characters) for *Ergasilus*, CI=0.64, tree length = 59.27.

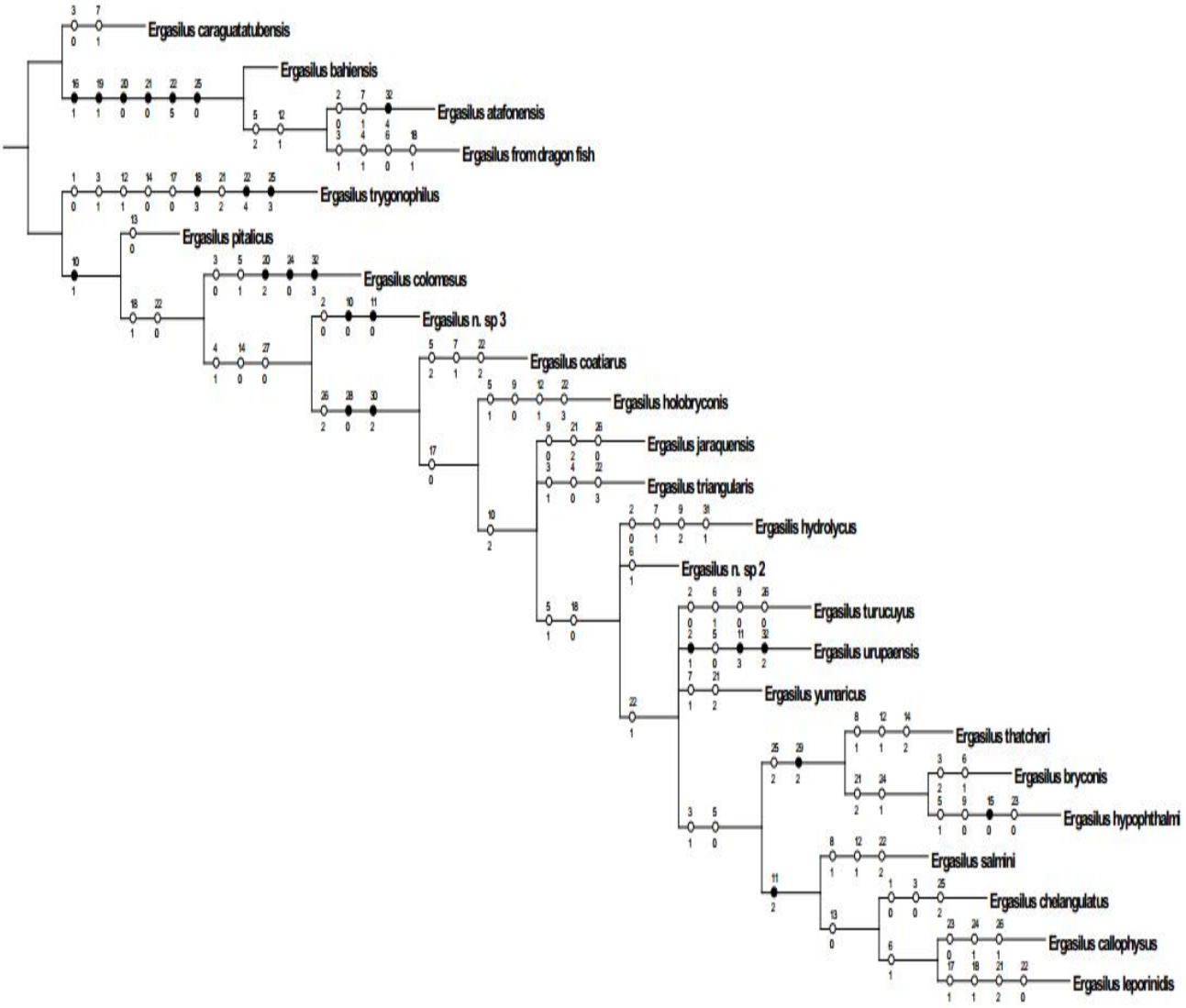


Figure 142: Phylogenetic hypothesis based on morphologic data (33 characters) for *Ergasilus*, showing the distribution of states of characters. Black point represents synapomorphies and white points represent homoplasies.

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Discussion

Contrary to what could be expected, the phylogenetic relationship of the *Ergasilus* spp. indicate extensive host switching events throughout its diversification considering both host orders or families. Parasites of freshwater Perciformes, Siluriformes and Characiformes do not form reciprocal monophyletic assemblages in the cladogram. The only known parasite of a

freshwater elasmobranch is also a strong evidence of the importance of host switch events in the history of the host-parasite association within the genus. Even parasites of fishes of a same genus/species are not members of a clade. Parasites of species of *Salminus* are not sister groups what evidences dispersion events likely associated with temporal and spatial opportunities.

One explanation for the great diversity found among copepods parasites comes from the context of its historical ecology. According to MCLENNAN & BROOKS (1993) the opportunity for host colonization and subsequent speciation is the inverse to the degree of host specificity. This means that the higher the number of hosts that a species is able to parasitize, the better its changes of finding a new host and colonizer. This diversity pattern is found in other parasites, such as the Gyrodactylidae (Monogenoidea Platyhelminthes) as suggested by BOEGER *et al.* (2003). Genetically diverse species of viviparous Gyrodactylidae have ample opportunities for infesting other sympatric host species. As evidenced by the cladogram (Fig. 141) distant host strains do not seem to limit the parasite ability to host switch.

Further, the phylogeny shows that there are two distinct lineages, one composed of the known ergasilids of marine waters, represented by the outgroup, and another composed of freshwater species. The monophyletic of freshwater group is supported by the leg V reduced to two setae (character 31) and the number of setae in the caudal rami, the clade has a long seta, medium and two short setae (character 32).

Some other clades constantly appear together on the analysis of distribution state of the characters. It is the case of *Ergasilus thatcheri* +; *E. thatcheri, E. bryconis* and *E. hypophthalmi*; *E. trygonophilus*, *E. pitalicus*, *E. colomesus* and *E. sp. n*. 3; and *E. bahiensis*, *E. atafonenesis* and *E.* from dragon fish.

Another point to be highlighted is the positioning of *Ergasilus trygonophilus* , *E. pitalicus* and *E. colomesus* on phylogeny. These three species are closely related to outgroup mainly by having three segments in the endopod of leg IV (character 28), being the most basal among clade of freshwater. This three species are parasites of fishes secondarily of freshwater: the Ciclidae (Perciformes), Potamotrygonidae (Myliobatiformes) and

Tetraodontidae (Tetraodontiformes), which is the probable invasion of gender in inland waters in South America along with their hosts derived from marine environments .

Despite having several homoplasy events, phylogenetic analysis proved to be informative and relevant to the elucidation of the relationship of *Ergasilus* species in the Neotropical Region.

Further, the fauna of the species of *Ergasilus* in the Neotropics is apparently composed by at least two distinct lineages. One lineage, represented by *E. colomesus*, apparently derived from the marine environment, which likely colonized the continental aquatic environments in South America with its host, a Tetradontiformes, and another lineage present solely in freshwater species. Curiously this second lineage/clade, depicts as basal species parasites of secondarily freshwater groups, the Cichlidae (Perciformes) and the Potamotrygonidae (Myliobatiformes). Despite the conspicuous difference in the freshwater origin of these two groups of fishes, this result appears to suggest that the origin of this lineage of freshwater *Ergasilus* may be a consequence of an older colonization of freshwater. Indeed, the relative position of the hypothetical ancestral of this clade and that of *E. colomesus* support his conclusion.

This study was necessary, since most of the described species needed to be redescribed. The present cladogram and associated conclusions on the historical ecology of the species of *Ergasilus* in the Neotropics is certainly, limited by the scarce knowledge on the diversity of the group in the region. Species of *Ergasilus* started being reported and described on earlies 1980's (e.g. *E. leporinidis, E. jaraquensis, E. colomesus*) but the rate of species descriptions have dropped most recently reflecting not the low diversity in the group but the lack of interest of scientists on the Ergasilidae. Further discoveries and the inclusion of molecular data should inevitably enhance the understanding on the evolution of the clade in South America.

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Appendix

Morphological terminology

Morphology of the body of Ergasilidae closely resembles the free-living relatives. Below we present a description of the general structure of the body and parts of species of this family strongly based on El-Rashid (1999) (Figures 142-150).

The body of ergasilids is divided into two functional regions: the prosome and the urosome (Figure 142). The prosome consists of the cephalothorax and three free pedigerous somites. The cephalothorax is usually composed of the cephalosome and the first pedigerous somite, although a non-functional articulation often separates these two parts. The cephalosome bears five pairs of appendages; antennules, antennae (modified as prehensile organs), mouthparts including the mandibles, maxillules and maxillae (Figure 145)

The antenna (also known as second antenna) is modified from the primitive free-living counterpart as a grasping organ for attachment to the host. It is uniramous and composed of coxobasis (fused coxa and basis) and 3-segmented endopod plus a curved claw (Figure 143)

The antennule (also known as first antenna) is a sensory organ, uniramous with six segments armed with setae and aesthetascs (Figure 144)

Each pedigerous somite contains a pair of birremous legs used in swimming (Figure 142).

Legs I to IV comprise coxa, basis, two rami, the exopod and the endopod. Each ramus may have one to three segments and are ornated with spines and/or pilouse setae, all of those reprenting an important character for the determination of species (Figures 147-149). Leg V is always vestigial and, freshwater neotropical species, may be armed with one or two distal setae (Figure 9).

The urosome consists of a small fifth pedigerous somite, the genital somite, the three free abdominal somites, and the fifth pedigerous somite bearing leg V (Figure 150).

The caudal rami (or uropods) are unsegment and situated on the posterior margin of the anal somite. Each caudal ramus bears four elements: a large medial seta, inner terminal seta located next to the medial seta, the outer terminal seta, and a posterolateral seta.

The mouth parts are formed by a pair of mandible, maxilla and maxillule (Figure 145). The maxilliped is present only in males. The mandible generally formed by three blades equipped with sharp teeth, one of which may be absent in some species. The maxilla (Mx) is composed of a syncoxa end and a base, with teeth on the upper side. It may also have a spinulate seta. The maxillule (Mxl) is a small plate located between the mandible and the maxilla, and may present two setal elements in its middle region.

Finnally, egg sacs may be present in mature females. These vary in size, diameter, and organization of the eggs according to the species. Eggs sacs are inserted to the genital opening of the dorsal surface of the genital segment.

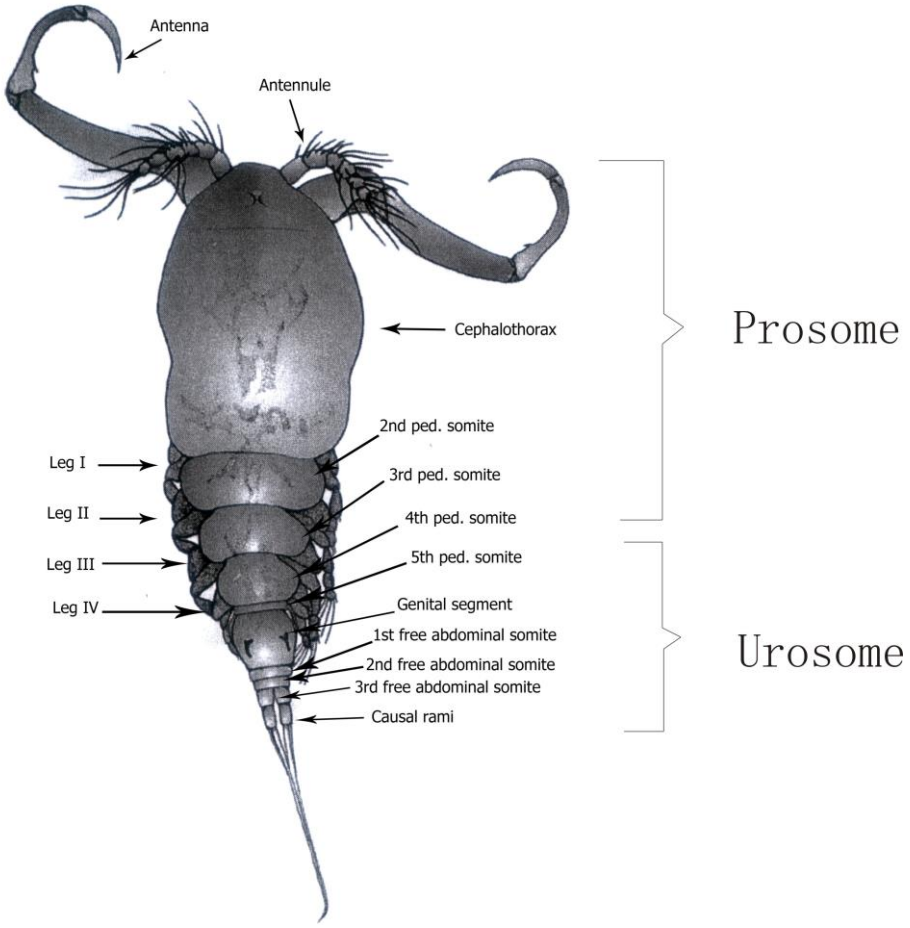

Figure 143: *Ergasilus thatcheri.* Female, dorsal view. Source: Engers *et al*., 2000.

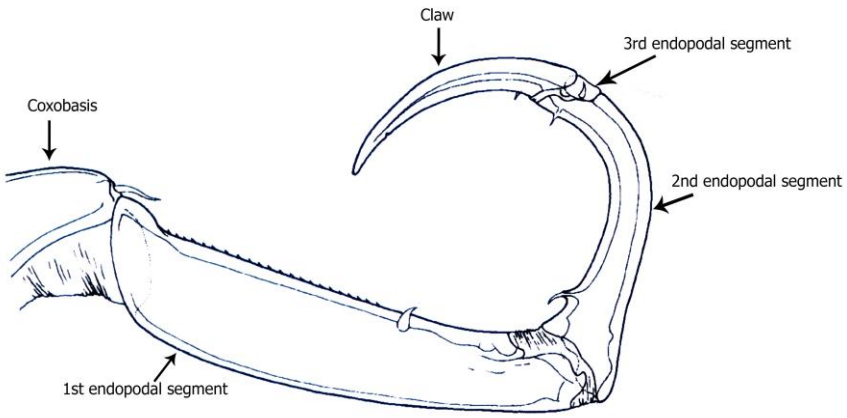

Figure 144: *Ergasilus thatcheri.* Antenna. Source: Engers *et al*., 2000.

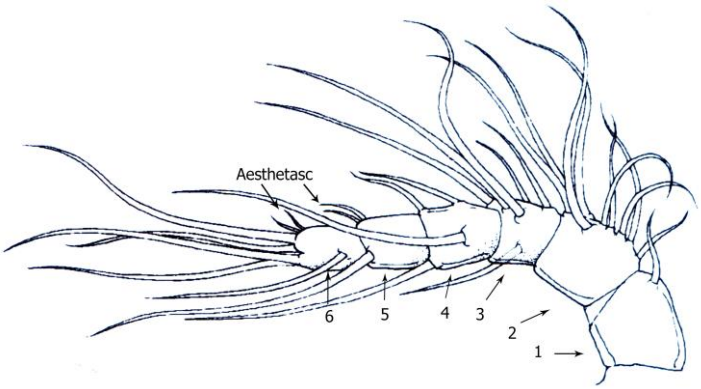

Figure 145: *Ergasilus thatcheri.* Antennule. Source: Engers *et al*., 2000.

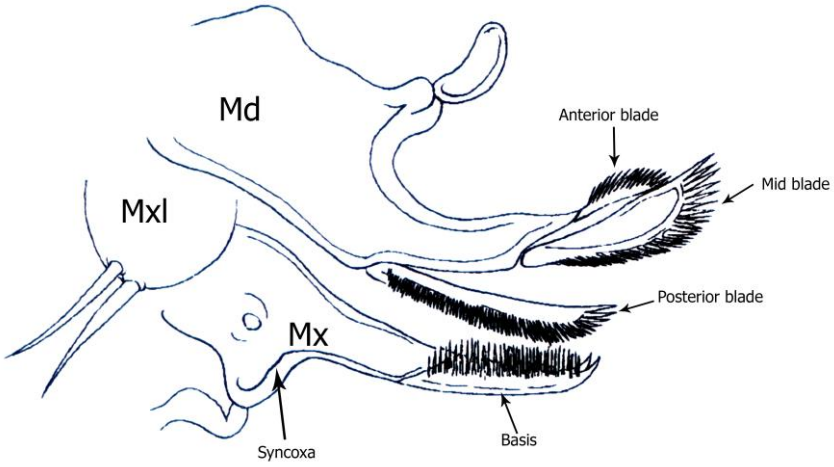

Figure 146: *Ergasilus thatcheri.* Mouth parts. Source: Engers *et al*., 2000.

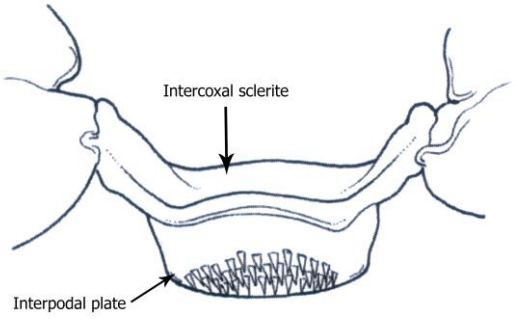

Figure 147: *Ergasilus thatcheri.* Intercoxal sclerites. Source: Engers *et al*., 2000.

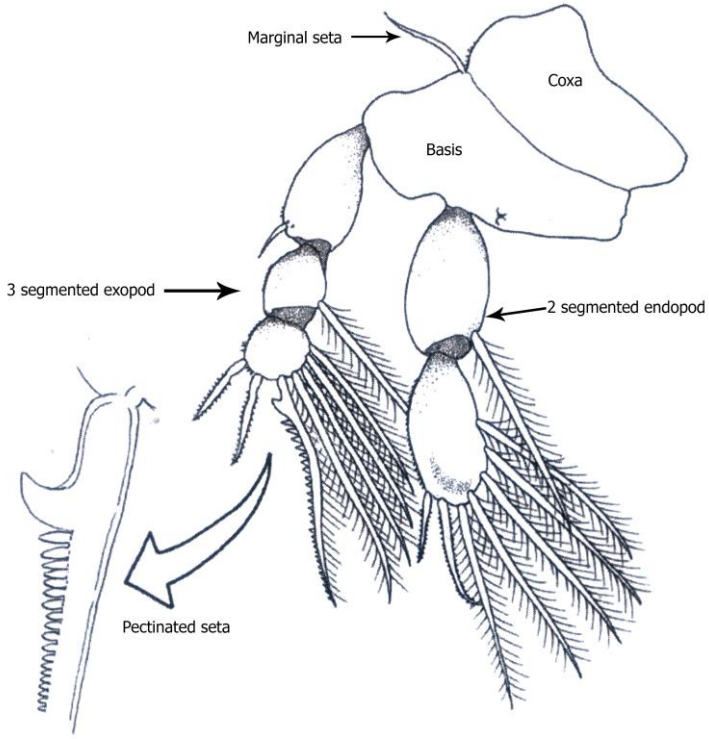

Figure 148: *Ergasilus thatcheri.* Leg I. Source: Engers *et al*., 2000.

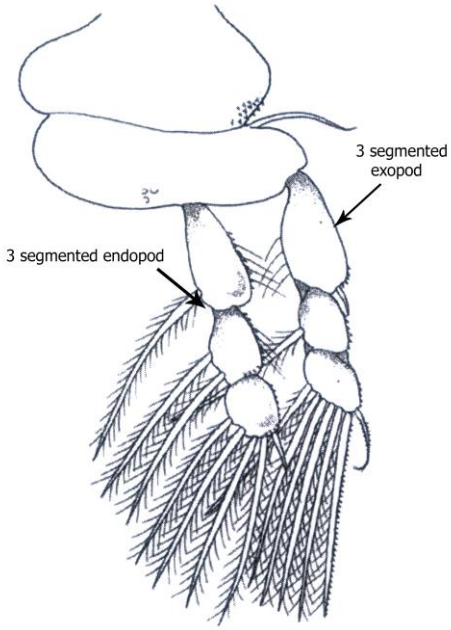

Figure 149: *Ergasilus thatcheri.* Legs II and III similar. Source: Engers *et al*., 2000.

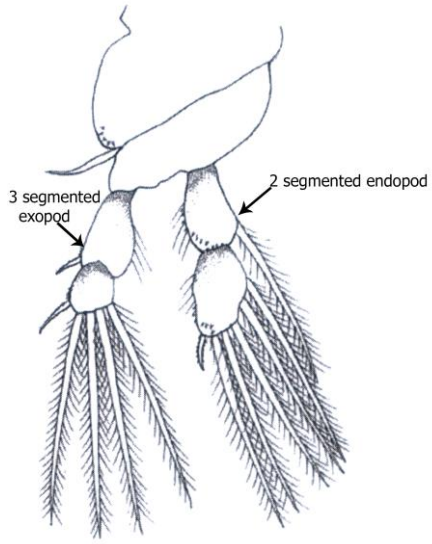

Figure 150: *Ergasilus thatcheri.* Leg IV. Source: Engers *et al*., 2000.

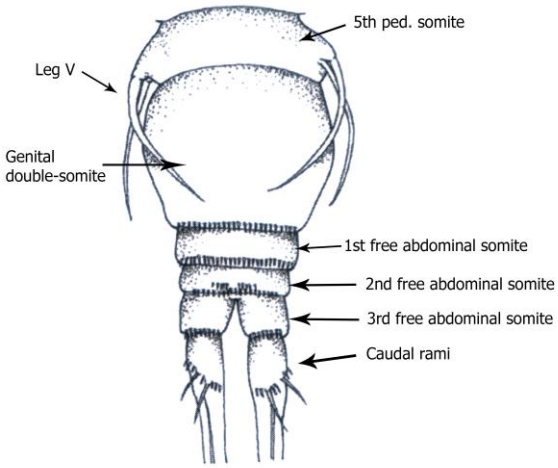

Figure 151: *Ergasilus thatcheri.* Urossomo of adult female, ventral view

Character List

All character were used in descriptions, those who are represented by # were used in the key.

#1. Cephalossome shape/
    1. inflated/
    2. not inflated/
#2. Length of cephalotorax/
    1. Twice as long than wide,/
    2. lenght less than twice the width,/
#3. Relative Length of cephalotorax/
    1. nearly 50% of body length;/
    2. Shorter than 50% of body length;/
    3. longer than 50% of body length;/
#4. cephalotorax and first pedigerous/
    1. fused./
    2. partialy fused ./
    3. not fused ./
5. Antenna with/
    1. coxa, three endopod segments, claw;/
    2. coxa, two endopodal segments, claw;/
#6. coxa/
    1. presenting a short distal seta,/
    2. lacking seta,/
#7. Membrane between coxa and first segment of endopod/
    1. inflated;/

2. not inflated;/
#8. length/width ratio of first endopodal segment of antenna/
1. greater than 3,/
2. Smaller than 3,/
3. approximately 3,/
#9. cuticular elevation on sensillum of first endopodal segment/
1. absent,/
2. present,/
#10. Sensilum on first endopodal segment of antena/
1. proximal,/
2. Sub-distal,/
3. near midlength,/
#11. internal margin of first endopodal segment of the antena/
1. with spinules;/
2. lacking spinules;/
#12. Second segment/
1. curved and shorter than first segment,/
2. Shorter than first segment,/
3. curved, as long as first segment,/
4. curved, longer than first segment,/
#13. Second endopodal segment presenting/
1. Two sensila;/
2. one sensillum;/
3. lacking sensillum;/
#14. proximal sensillum/
1. Small;/
2. larger than distal;/
3. absent;/
15. Third endopodal segment/
1. with a single seta at the articulating membrane;/
2. lacking seta or not observed;/
#16. claw/
1. proximaly recurved at about 90 degrees./
2. evenly curved./
17. Antenulle with/
1. 6 segments,/
2. 5 segments,/
#18. aesthetascs/
1. absent or not observed./
2. present on fifth and sixth segment./
3. Two on fifth and three on sixth segment./
4. one on fifth and three on sixth segment./
19. Mouth parts comprising/
1. Mandible, maxilla, maxillule; maxiliped absent;/
2. comprising mandible, maxilla, maxillule and maxiliped;/
3. not observed;/
#20. Mandible with/
1. anterior, median, posterior blades;/
2. Median and posterior blades; anterior blade absent;/
21. Median blade of mandible/

1. anteriorly toothed,/
#22. Basis of maxilla/
1. partially toothed on convex margin,/
2. completelly toothed,/
23. Spinulate seta on maxilla/
1. present;/
2. absent;/
#24. Two setal elements on maxilulle/
1. absent or not observed./
2. present./
#25. Interpodal plates/
1. with distal row of spinules./
2. lacking spinules./
3. with spinules ventrally./
26. Leg I/
#27. Leg 1 Basis/
1. with conspicuous pointed projection at base of exopodite,/
2. with smooth margins,/
#28. Spinules <on basis>/
1. present,/
2. absent,/
#29. Basis/
1. with external seta./
2. lakcing external seta./
30. Exopod with/
1. 3 segments;/
31. first segment of exopod/
1. with spinules on entire outer margin,/
2. with spinules distally on outer margin,/
3. lacking spinules,/
32. First segment of exopod leg I/
1. pilose,/
2. not pilose,/
#33. Number of setae 1° segment exopod leg I/
1. with one seta,/
2. lacking seta,/
#34. Distal spine on outer margin of first segment/
1. present;/
2. absent;/
35. Second segment of exopod/
1. with spinules on entire outer margin,/
2. lacking spinules,/
3. with distal spinules on outer margin,/
#36. Number of setae on 2° segment of exopod leg I/
1. with one seta,/
2. lacking seta,/
#37. Distal outer spine on second segment/
1. present;/
2. absent;/
#38. Third segment of exopod of leg I/

1. with one pectinated seta and four pilose setae,/
2. lacking pectinated seta, with four pilose setae,/
3. lacking pectinated seta, with five pilose setae,/

39. Spinules third of segment of exopod of leg I/
1. with spinules on entire outer margin,/
2. with spinules distally on outer margin,/
3. lacking spinules,/

#40. Two distal outer spines <on third segment of exopod/
1. with spinules./
2. lacking spinules./
3. only the outer spine with spinules./
4. one of them with membrane on the outer margin./

#41. Endopod of leg I/
1. with 2 segments;/
2. with 3 segments;/

42. first segment/
1. with spinules on entire outer margin,/
2. lacking spinules,/
3. with spinules distally on outer margin,/

43. inner margin/
1. pilose,/
2. not pilose,/

44. Number os setae on 1° segment of endopod leg I/
1. with one seta;/
2. lacking seta;/

45. Second segment <of endopod of leg I/
1. with spinules on entire outer margin,/
2. with distal spinules on outer margin,/
3. lacking spinules,/

#46. Second segment of endopod of leg I/
1. with rosette-like array of blunt spinules,/
2. without rosette-like array of blunt spinules,/

#47. Number of setae on 2 segment of endopod leg I/
1. with one seta,/
2. with two setae,/
3. with five setae,/
4. with four setae,/

#48. Spines 2 on second segment of endopod of leg I/
1. absent;/
2. Straight,/
3. curved,/
4. long, one curved,/
5. one long spine and one small spine,/

49. Spines/
1. Both ornated with spinules./
2. only one with spinules./
3. lacking spinules./
4. one of them ornated with a serrate membrane./
5. Both ornated with serrate membrane./

50. Third segment of endopod of leg I/

1. Showing spinules on entire outer margin,/
2. lacking spinules,/
3. with distal spinules on outer margin,/

51. Two distal spines <third segment of endopod of leg I/
1. with a serrate membrane,/

52. Number of setae on 3 segment of endopod leg I/
1. with four setae./
2. with five setae./
3. with three setae./

53. Legs II and III/

54. Basis/
1. ornated with spinules,/
2. lacking spinules,/

55. Basis/
1. lacking external seta./
2. with external seta./

#56. Coxa/
1. with a strong and curved spine./
2. lacking spine./
3. with spinules./

57. Exopod/
1. presenting 3 segments;/
2. presenting 2 segments;/

58. first exopod segment 1/
1. pilose on inner side,/
2. not pilose,/

59. Number of setae first segment of exopod leg II/
1. lacking seta,/

60. First segment of exopod of leg II III/
1. with spinules on all outer margin,/
2. lacking spinules,/
3. with spinules distally on outer margin,/

61. outer spine first segment exopod of leg II III/
1. absent;/
2. present with spinules on outer margin;/
3. present, lacking spinules;/

62. Second segment of exopod leg II III/
1. with spinules on entire outer margin,/
2. with spinules distally on outer margin,/
3. lacking spinules,/

#63. Number of setae second segment exopod leg II/
1. with one seta,/
2. lacking seta,/

#64. Distal outer spine on 2° segment exopod leg II III/
1. present and small;/
2. present with spinules;/
3. present;/
4. absent;/

65. Third segment/
1. with spinules on entire outer margin,/

2. lacking spinules,/
3. with spinules distally on outer margin,/

#66. Number of setae 3 segment exopod leg II III/
1. with six setae,/
2. with five setae,/

67. Spine on third segment exopod leg II III/
1. absent./
2. present and ornated with spinules./
3. present lacking spinules./

68. Endopod/
1. with 3 segments;/
2. with 2 segments;/

69. first segment/
1. with spinules on entire outer margin,/
2. lacking spinules,/
3. with spinules distally on outer margin,/

70. First segment endopod leg II III/
1. pilose,/
2. not pilose,/

#71. Number of setae first segment endopdo leg II III/
1. with one seta;/
2. lacking seta;/

72. Second segment/
1. with spinules on entire outer margin,/
2. with spinules distally on outer margin,/
3. lacking spinules,/

73. Second segment/
1. pilose,/
2. not pilose,/

#74. Number of setae 2 segment endopod leg II III/
1. with one seta,/
2. with two setae,/

#75. Distal outer spine <second segment endopod leg II III/
1. present and ornated with spinules;/
2. present lacking spinules;/
3. absent;/

76. Third segment endopod leg II III/
1. with spinules on entire outer margin,/
2. lacking spinules,/
3. with spinules distally on outer margin,/

#77. Number of setae 3 segment endopod leg II III/
1. with four setae,/
2. with five setae,/
3. with three setae,/

78. Distal outer spine/
1. present./
2. absent./
3. present with spines./
4. present with a membrane./

79. Leg IV/

80. Basis/
    1. ornated with spinules,/
    2. lacking spinules,/
81. Basis/
    1. lacking external seta./
    2. with external seta./
#82. Coxa/
    1. lacking spine./
    2. with a strong and curved spine./
    3. with spinules./
#83. Exopod with/
    1. 1 segment;/
    2. 2 segments;/
84. first segment exopod leg IV/
    1. with spinules on entire outer margin,/
    2. lacking spinules,/
    3. with spinules distally on outer margin,/
85. First segment exopod leg IV/
    1. pilose,/
    2. not pilose,/
86. Number of setae 1 segment exopod leg IV/
    1. lacking seta,/
    2. with four setae,/
87. Distal outer spine first segment of exopod leg IV/
    1. absent;/
    2. present and ornated with spinules;/
    3. present;/
88. Second segment exopod leg IV/
    1. with spinules on entire outer margin,/
    2. lacking spinules,/
    3. with spinules distally on outer margin,/
#89. Number of setae 2 segment exopod leg IV/
    1. with four setae,/
    2. with five setae,/
90. Distal spine second segment exopod leg IV/
    1. present./
    2. absent./
    3. present with spinules on outer margin;./
#91. Endopod with/
    1. 2 segments;/
    2. 3 segments;/
92. first segment endopod leg IV/
    1. lacking spinules,/
    2. with spinules on entire outer margin,/
    3. with spinules distally on outer margin,/
93. Number of setae 1 segment endopod leg IV/
    1. with one seta;/
94. First segment endopod leg IV/
    1. pilose;/
    2. not pilose;/

95. Second segment endopod leg IV/
    1. with spinules on entire outer margin,/
    2. lacking spicules,/
    3. with spinules distally on outer margin,/
#96. Number of setae 2 segment endopod leg IV/
    1. with two setae,/
    2. with five setae,/
    3. wth four setae,/
#97. Distal outer spine second segment of endopod leg IV/
    1. absent;/
    2. present;/
    3. present ornated with spinules;/
#98. Third segment endopod of leg IV/
    1. with spniules on entire outer margin,/
    2. lacking spinules,/
    3. with spinules distally on outer margin,/
99. Number of setae 3 segment endopod leg IV/
    1. with three setae,/
    2. with four setae,/
100. Distal outer spine third segment of endopod leg IV/
    1. present./
    2. absent./
#101. Leg V reduced/
    1. To two distal setae, one longer than other./
    2. To one single seta./
    3. Three setae and spinules./
    4. To two segments, basal segment with a single seta, and terminal with three setae./
102. Genital segment/
    1. ornate with spinules on posterior margin,/
    2. lacking spinules,/
    3. ornate with spines ventrally,/
103. Segmento genital/
    1. with lateral sensila./
    2. lacking lateral sensila./
#104. Abdominal segments 3/
    1. with spinules on entire posterior margin./
    2. lacking spinules./
    3. presenting spinules on lateral region of posterior margin./
#105. Caudal rami/
    1. longer than wide,/
    2. wider than long,/
    3. as long as wide,/
#106. Setae on inner margim of caudal rami/
    1. with setae on inner margin,/
    2. lacking setae on inner margin,/
107. presenting setae on caudal rami/
    1. one long, one median and two short setae,/
    2. one long, two median pilose distally and one short setae,/
    3. one long and three short setae,/

4. one long, one medium and three short setae,/
5. one long, two medium and two short setae,/

#108. Spinules caudal rami/
1. present./
2. absent./

109. Egg sac/
1. Short./
2. elongate./
3. not observed./