Acta Scientiarum. Biological Sciences
ISSN: 1679-9283
actabiol@uem.br
Universidade Estadual de Maringá
Brasil

Cardoso de Jesus, Elson; Cardoso, Lucas; Henrique Ferreira, Tamiris; Laterça Martins, Mauricio; Nunes Rodrigues, Marília Danyelle
Braga nasuta (Cymothoidae): an ectoparasite of the Giant Amazonian fish Arapaima gigas (Osteoglossidae) fingerlings cultured in the Amazon region in Northern Brazil
Acta Scientiarum. Biological Sciences, vol. 39, núm. 4, october-december, 2017, pp. 507-511
Universidade Estadual de Maringá
Maringá, Brasil

Acta Scientiarum

http://www.uem.br/acta
ISSN printed: 1679-9283
ISSN on-line: 1807-863X
Doi: 10.4025/actascibiolsci.v39i4.35080

Braga nasuta (Cymothoidae): an ectoparasite of the Giant Amazonian fish *Arapaima gigas* (Osteoglossidae) fingerlings cultured in the Amazon region in Northern Brazil

Elson Cardoso de Jesus[1], Lucas Cardoso[2], Tamiris Henrique Ferreira[2], Mauricio Laterça Martins[2] and Marília Danyelle Nunes Rodrigues[1*]

*[1]Universidade Federal Rural da Amazônia, PA 275, s/n, Cx. Postal 3017, 68515-970, Campus Parauapebas, Parauapebas, Pará, Brazil. [2]Laboratório AQUOS, Sanidade de Organismos Aquáticos, Departamento de Aquicultura, Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brazil. *Author for correspondence. E-mail: nunes.mdnunes@gmail.com*

ABSTRACT. Isopods Cymothoidae are organisms that parasitize several fish species, both marine and freshwater, provoking important physiological alterations and secondary infections. The genus *Braga* was proposed to harbor three species of parasitic isopods in freshwater fish from South America: *B. brasiliensis, B. cichlae* and *B. nasuta*. Posteriorly, other four species were included: *B. patagonica*, *B. amapaensis*, *B. fluviatilis* and *B. bachmanni*. Regarding the geographical distribution of the genus, there are registers in Brazil, Argentina, Suriname and Paraguay. In this study, 3,625 fingerlings of pirarucu *Arapaima gigas* were examined from a commercial fish farm in the Amazon region, Pará State, to observe and identify possible parasites. A total of eleven ectoparasitic isopods were carefully removed from the body surface of the hosts and fixed in alcohol 70%. They were processed and identified as *Braga nasuta*. Parasitological indexes were prevalence of 0.303%, mean intensity of 1.000±0.000 and mean abundance of 0.003±0.055. This is the first report of *B. nasuta* in pirarucu fingerlings.

Keywords: Amazon, pirarucu, farming, parasite, isopoda.

Braga nasuta (Cymothoidae): um ectoparasito de alevinos do peixe gigante da Amazônia *Arapaima gigas* (Osteoglossidae), cultivado na região Amazônica, no Norte do Brasil

RESUMO. Isópodes Cymothoidae são organismos que parasitam ampla variedade de espécies de peixes, tanto marinhos quanto dulcícolas, provocando importantes alterações fisiológicas e infecções secundárias. O gênero *Braga* foi proposto inicialmente para abrigar três espécies de isópodes parasitos de peixes de água doce da América do Sul: *B. brasiliensis, B. cichlae* e *B. nasuta*; posteriormente, outras quatro espécies foram inseridas: *B. patagônica*, *B. amapaensis*, *B. fluviatilis* e *B. bachmanni*. Em relação à distribuição geográfica das espécies deste gênero, há registros no Brasil, na Argentina, em Suriname e no Paraguai. Neste estudo, 3.625 alevinos de pirarucu *Arapaima gigas* de uma piscicultura comercial na região amazônica, Estado do Pará, foram examinados para observar e identificar possíveis parasitos. Ao total, foram encontrados onze isópodes ectoparasitos, cuidadosamente retirados da superfície corporal de hospedeiros e fixados em álcool 70%. Eles foram processados e identificados como *Braga nasuta*. Os índices parasitológicos tiveram prevalência de 0,303%, intensidade media de 1.000±0.000 e abundância média de 0,003±0,055. Este é o primeiro relato de *B. nasuta* em alevinos de pirarucu.

Palavras-chave: Amazônia, pirarucu, cultivo, parasito, isópoda.

Introduction

Isópodes Cymothoidae Leach, 1818, has parasitic habits (Brusca, Coelho, & Taiti, 2001) and its morphological structures are prehensile pereopods provided by long claws, strong and curved, buccal pieces highly modified for parasitic life (Thatcher, 2006). After living the marsupium, the cymothoid juveniles are ready to attach and feed on small fishes (Leonardos & Trilles, 2003).

The family Cymothoidae harbor more than sixty genera and one of them is *Braga* Schiöedte and Meinert, 1881, with six species, which was firstly proposed to harbor parasitic isopods of freshwater fish from South America. According to Thatcher (2006), specimens of the genus can be found in tongue and operculum cavity of the hosts, they have symmetric body, cephalon little immersed in pereonite 1, all seven pairs of pereopods prehensile and provided with stout claw-like dactyls and pleotelson usually wider than long.

In Brazil, these parasites were reported on the following hosts: *B. amapaensis* in the mouth of *Acestrorhynchus microlepis* from Amapá (Thatcher,

1996; Eiras, Takemoto, & Pavanelli, 2010), *B. patagonica* in the gills of *Hoplias malabaricus* from Macapá (Alcântara & Tavares-Dias, 2015), *B. nasuta* in the mouth of *Hypostomus* sp. from Amazonas, Bahia and São Paulo (Thatcher, 2006), *B. cichlae* in *Cynopotamus humeralis*, *Cichla ocellaris* and *C. temensis* from São Paulo, Minas Gerais, Pará and Amazonas (Thatcher, 2006), *B. fluviatilis* in unidentified catfish (Thatcher, 2006).

Arapaima gigas Schinz, 1822, commonly known as pirarucu or arapaima, is considered one of the biggest freshwater fish reaching approximately 200 Kg and 2.5 m long (Ono, Roubach, & Pereira-Filho, 2003; Saint-Paul, 1986). Fish distributed in the Amazon basin, *A. gigas* has been target of commercial fisheries in the Amazon River and its tributaries, as well as in the flooded areas, i. e., igapós, causing damage to the natural stocks (Imbiriba, 2001). Due to easy handling, rapid growth and weight gain, the excellent survival rate of fingerlings, good acceptability of extruded diet, its tolerance to stocking density, aerial breathing, good acceptance of its meat and high value in the market, this species has been produced in commercial fish farm, as an alternative to predatory fishery (Imbiriba, 2001; Ono, Halverson, & Kubitza, 2004; Pereira-Filho et al., 2003). Nevertheless, high stocking density and inadequate fish handling are responsible for stress, imbalance in the host-parasite-environment relationship provoking a portal of entry to diseases and economic losses (Martins, 2004; Lemos, Rodrigues, & Lopes, 2006).

This study identified the isopods from the fingerlings of pirarucu cultured in earthen ponds from a fish farm located in the Amazon region, Pará State.

Material and methods

Fingerlings were collected from a commercial fish farm in the in the city of Parauapebas, Pará State (05° 59'S, 49° 53'W) between May and August 2016 (Figure 1). Fingerlings were from earthen ponds with abundant vegetation on the edges. Fish were collected from two spawnings (Figure 2) that occurred in two earthen ponds with 1,680 m^3 (12 x 70 x 2 m), harvested from a couple weighing 90 kg each. Reproduction is natural with spontaneous spawning inside the ponds where the fingerlings are captured at the age of 20 days.

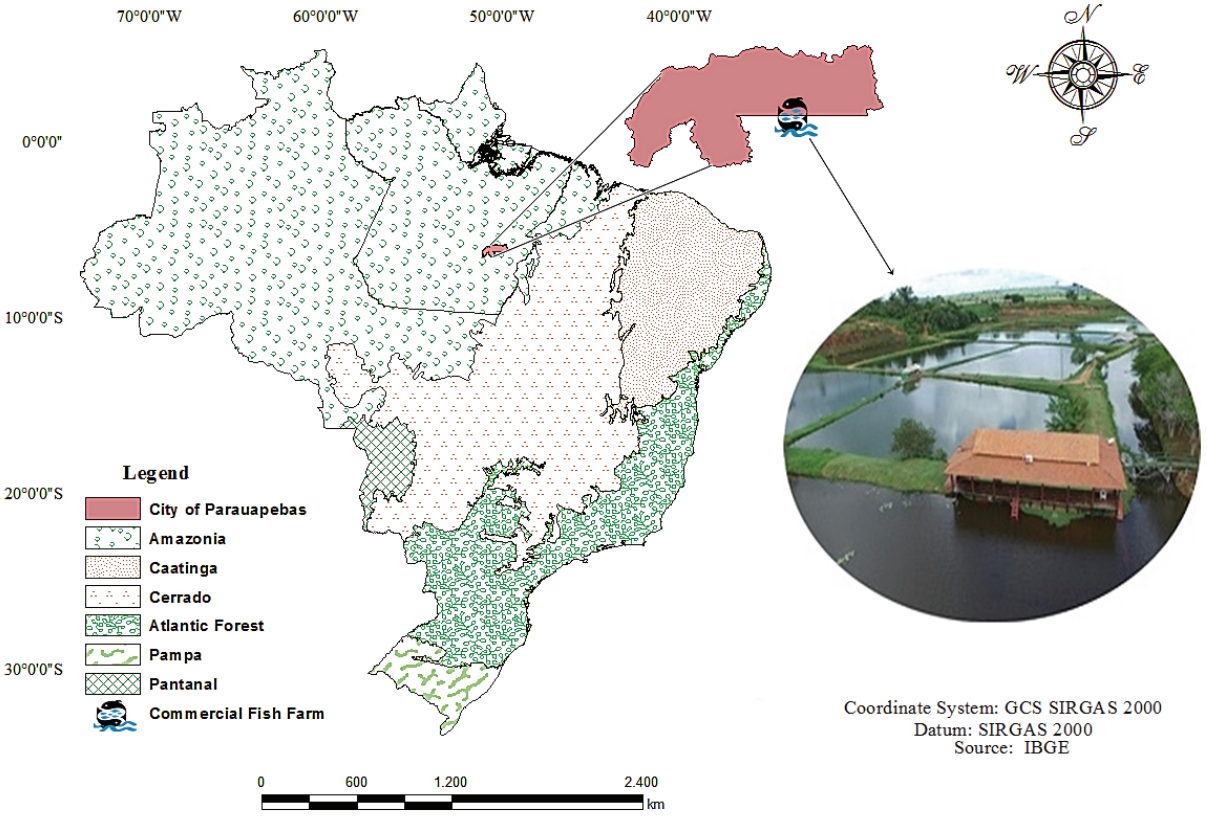

Figure 1. Commercial fish farm located in the Amazon region, Pará State.

Figure 2. Fingerlings of pirarucu, *Arapaima gigas,* collected from a commercial fish farm located in the Amazon region, Pará State. A- fish with approximately 10 g transferred to nursery, B- presence of ectoparasites on the body surface, C-lateral view of the parasite attached on the fish body.

A total of 3,625 of pirarucu with approximately 10 g were transferred to nursery for feeding training and observation. During feeding training, the fingerlings were carefully observed in relation to the presence of ectoparasites on the body surface. The parasites were collected, fixed and processed according to Eiras, Takemoto, and Pavanelli (2006). The specimens were measured (total length and width) and dissected to observe the anatomic pieces after cleared with phenol. Antenna, antennula, maxilla, maxillule, maxilliped, pereon, pleon, pereopods, pleopods, pleotelson and uropods were mounted between a depressed slide and a coverslip for observation and measurement in a Leica EZ4HD stereomicroscope (Thatcher, Oliveira, & Garcia, 2009). The vouchers were deposited at the Aquatic Organisms Health Laboratory of the *Universidade Federal de Santa Catarina* (CCA, UFSC) Aquaculture Department, Florianópolis, Santa Catarina, Brazil (AQUOS-ISO-1). The marsupium was carefully opened from a female specimen to observe the eggs. Identification was according to Lemos de Castro (1959), Thatcher (1995, 1997, 2006), Thatcher et al. (2009). Parasitological descriptors such as prevalence, mean intensity and mean abundance followed the Bush, Lafferty, Lotz, and Shostak (1997) recommendation.

Results

Macroscopic observation revealed the presence of a total of eleven specimens (seven females and four males) of the isopod *Braga nasuta* from the ventral region close to pectoral fin and anus, collected from parasitized fingerlings (Figure 3). Males were 14.06 ± 2.3 mm long by 6.46 ± 1.2 mm wide and females 23.0 ± 2.8 mm long by 13.0 ± 1.4 mm wide. The prevalence was 0.303%, intensity 1.000 ± 0.000 and mean abundance 0.003±0.055. In just one female 26 mancas were found comprising the stage I of development.

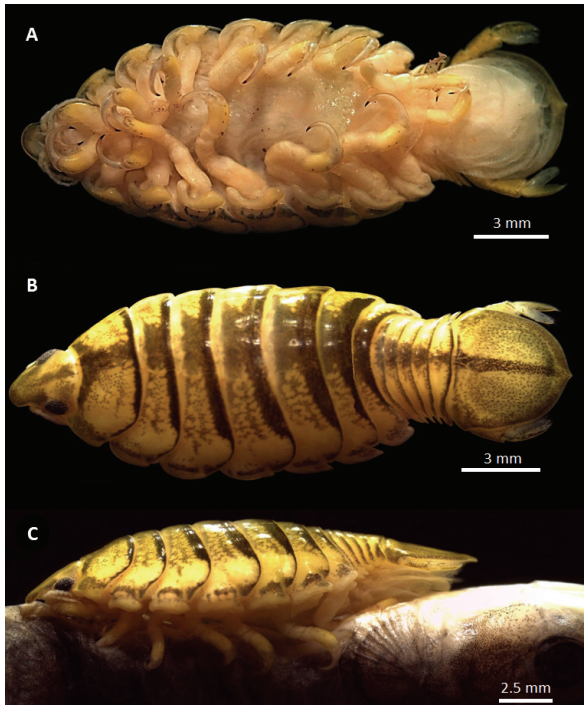

Figure 3. *Braga nasuta* specimen from cultured *Arapaima gigas*. A- ventral view, B-dorsal view, C-lateral view of the parasite attached on the fish body.

Discussion

In relation to site of attachment, species of the genus *Braga* commonly attach to the operculum cavity, gills or wounds opened on the fish body (Lemos de Castro, 1959; Thatcher, 2006). Dias, Neves, Marinho, and Tavares-Dias (2015) have observed *B. patagonica* on the dorsal region of C. *macropomum* causing loss of scales and tegument culminating in an inflammatory process. In contrast to that reported by Dias et al. (2015), in the present study the parasites did prefer the ventral region of the host or close to pectoral fin and anus. No mortality was found due to the parasitic infestation. The prevalence rate was low

and parasitized hosts showed weight loss, hemorrhages and inflammatory reaction on the attachment site.

Members of the Cymothoidae Family could cause loss of blood, reduced gill filaments and prejudiced respiratory efficiency (Carvalho, Arruda, & Del-Claro, 2004), besides reduced growth. This parasitism results in ulcerative lesions that opens a portal of entry for secondary infections by bacteria, fungi and viruses (Leonardos & Trilles, 2003; Hirano et al., 2006; Martins, 2004).

Some of these alterations previously reported were found in the present study in pirarucu fingerlings parasitized by *B. nasuta*. As for example, in the attachment region epithelial perforations and hemorrhages, weight loss and deepening of the ventral region of the host were clearly observed. However, only the histopathological and hematological analysis could confirm the pathogenic action.

Apart from the variations that occur in different fish stages like habit, parasitological indices herein observed were too low and were similar to that reported in tambaqui *Colossoma macropomum* parasitized by *Braga patagonica* (2.5% prevalence, intensity 1.0±0.2 and mean abundance 0.03) by Dias et al. (2015). Brandão et al. (2013) observed *Braga cigarra* from the buccal cavity of *Galeocharax knerii* captured from the Rivers Veados at 7.7% prevalence, Paranapanema at 31.7% prevalence and Taquari at 5.7% prevalence in Southeast Brazil. In fact, it is difficult to estimate the real prevalence of the parasites in fish due to fishery procedures that use net, leading the fish to escape from the capture, possibly allowing detachment of the parasite, which will search for a new host (Brandão et al., 2013). This event can also explain the low parasitic indices of *B. nasuta* found in cultured pirarucu in this study. Tavares-Dias, Araújo, Barros, and Viana (2014) were the first authors to register *B. patagonica* in cultured *C. macropomum* with 30% prevalence. They argued that the parasites had reached the ponds by the alien fish like traira *Hoplias malabaricus*, curimatã *Curimata cyprinoides* and red tail *Acestrorhynchus falcatus*) from the supplied water once the parasites were also found on those fish. These fish invaded the ponds of *C. macropomum* from the channels of water supply and by the presence of the parasites could be strongly considered as vectors of *B. patagonica* (Tavares-Dias et al., 2014). This fact was confirmed by Tavares-Dias et al. (2014) when analyzed alien fish parasitized by *B. patagonica* present in the channels of water supply for *C. macropomum* culture.

This situation could be occurred in this study, in which they were fed not only by ration but also by tilapia and curimatã fingerlings, even not having registers of *B. nasuta* in these species that serve as food to pirarucu. The most important prophylactic measure should be the parasitological examination to make sure if these fish used as food could be act as vector of parasites. Additionally, extending this analysis to other fish species could also reveal if *B. nasuta* is host-parasite specific or not.

The presence of cymothoid crustaceans in the natural environment was related by Vieira (2006) in a biological inventory of crustaceans from the basin of Sucuriju River, Lake region in the State of Amapá. The authors collected *Braga* cf. *fluviatilis* and *Braga* cf. *patagonica* from the aquatic and marginal vegetation in the wetland forest. This finding indicates that this parasite can be found in the vegetation increasing the possibility for fish parasitism as normally observed the abundant vegetation on the edges of pirarucu ponds.

Isopods of fish present not only biological importance but also economic one once in high infestations they can provoke significant losses in cultured fish (Eiras et al., 2010; Tavares-Dias, Dias-Júnior, Florentino, Silva, & Cunha, 2015). Cymothoids present morphological structures well adapted to parasitic life that damage the fish tissue. In fish farms, the best management practices to reduce the possibility of high infestations of parasites must be implemented to avoid secondary infections. It is also recommended to verify the water source that supply the ponds, realize adequate prophylactic fish handling, control the amount and quality of feeding, avoid the entrance of vectors and keep the water quality within the normal values for the species. This study presents the first report of the ectoparasite *B. nasuta* in farmed pirarucu.

Acknowledgements

The authors thank the Conselho Nacional (CNPq) for financial support to M.L. Martins (CNPq 305869-2014-0).

References

Alcântara, N. M., & Tavares-Dias, M. (2015). Structure of the parasites communities in two Erythrinidae fish from Amazon River system (Brazil). *Revista Brasileira de Parasitologia Veterinária*, *24*(2), 183-190.

Brandão, H., Toledo, G. M., Wunderlich, A. C., Ramos, I. P., Carvalho, E. D., & Silva, R. J. (2013). Occurrence of *Braga cigarra* (Cymothoidae) parasitizing *Galeocharax knerii* (Characidae) from affluents of Jurumirim reservoir, Brazil. *Revista Brasileira de Parasitologia Veterinária*, *22*(2), 292-296.

Brusca, R. C., Coelho, V., & Taiti, S. (2001). A Guide to the Coastal Isopods of California. *Tree of Life Web Project*. Retrieved from http://tolweb.org/notes/?note_id=3004

Bush, A. O., Lafferty, K. D., Lotz, J. M., & Shostak, A. W. (1997). Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology*, *83*(4), 575-583.

Carvalho, L. N., Arruda, R., & Del-Claro, K. (2004). Host-parasite interactions between the piranha *Pygocentrus nattereri* (Characiformes: Characidae) and isopods and branchiurans (Crustacea) in the Rio Araguaia basin, Brazil. *Neotropical Ichthyology*, *2*(2), 93-98.

Dias, M. K. R., Neves, L. R., Marinho, R. G. B., & Tavares-Dias, M. (2015). Parasitic infections in tambaqui from eight fish farms in Northern Brazil. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 67*(4), 1070-1076.

Eiras, J. C., Takemoto, R. M., & Pavanelli, G. C. (2010). *Diversidade dos parasitos de peixes de água doce do Brasil.* Maringá, PR: Clichetec.

Eiras, J. C., Takemoto, R. M., & Pavanelli, G. C. (2006). *Métodos de estudo e técnicas laboratoriais em parasitologia de peixes*. Maringá, PR: UEM.

Hirano, L. Q. L., Bosso, A. C. S., Vieira, L. G., Brito, F. M. M., Pereira, H. C., Silva Júnior, L. M., ... Santos, A. L. Q. (2006). Análise qualitativa e quantitativa de ectoparasitas de *Pygocentrus nattereri* Kner, 1860 (Characiformes: Characidae) da bacia do rio Araguaia, GO. *19ª RAIB Biológico*, *68*, 238-360.

Imbiriba, E. P. (2001). Potencial de criação de pirarucu, *Arapaima gigas,* em cativeiro. *Acta Amazonica*, *31*(2), 299-316.

Lemos de Castro, A. (1959). *Sobre as espécies sul-americanas do gênero Braga Schioedte et Meinert, 1881 (Isopoda: Cymothoidae)*. Rio de Janeiro, RJ: Arquivo do Museu Nacional.

Lemos, J. B., Rodrigues, M. E. B., & Lopes, J. P. (2006). Diagnóstico de ectoparasitas e bactérias em tilápias (*Oreochromis niloticus*) cultivadas na região de Paulo Afonso, Bahia. *Brazilian Journal of Fish Engineering*, *1*(1), 75-90.

Leonardos, I., & Trilles, J.-P. (2003). Host-parasite relationships: occurrence and effect of the parasitic isopod *Mothocya epimerica* on sand smelt *Atherina boyeri* in the Mesolongi and Etolikon Lagoons (W. Greece). *Diseases of Aquatic Organisms*, *54*(3), 243-251.

Martins, M. L. (2004). Cuidados Básicos e Alternativas no Tratamento de Enfermidades de Peixes na Aquicultura Brasileira. In M. J. T. Ranzani-Paiva, R. M. Takemoto, & M. de Los A. P. Lizama, (Eds). *Sanidade de Organismos Aquáticos* (p. 355-368). São Paulo, SP: Editora Varela.

Ono, E. A., Halverson, M. R., & Kubitza, F. (2004). Pirarucu, o gigante esquecido. *Panorama de Aquicultura*, *14*(81), 14-25.

Ono, E. A., Roubach, R., & Pereira-Filho, M. (2003). Pirarucu production: Advances in Central Amazon, Brazil. *Global Aquaculture Advocate*, *6*, 44-46.

Pereira-Filho, M., Cavero, B. A. S., Roubach, R., Ituassú, D. R., Gandra, A. L., & Crescêncio, R. (2003). Cultivo do Pirarucu (*Arapaima gigas*) em viveiro escavado. *Acta Amazonica*, *33*(4), 715-718.

Saint-Paul, U. (1986). Potential for aquaculture of south American freshwater fishes; a rewiew. *Aquaculture*, *54*(3), 205-240.

Tavares-Dias, M., Araújo, C. S. O., Barros, M. S., & Viana, G. M. (2014). New hosts and distribution records of *Braga patagonica*, a parasite cymothoidae of fishes from the Amazon. *Brazilian Journal of Aquatic Science and Technology*, *18*(1), 91-97.

Tavares-Dias, M., Dias-Júnior, M. B. F., Florentino, A. C., Silva, L. M. A., & Cunha, A. C. (2015). Distribution pattern of crustacean ectoparasites of freshwater fish from Brazil. *Brazilian journal of veterinary parasitology*, *24*(2), 136-147.

Thatcher, V. E. (2006). *Amazon fish parasites*. Sofia, Moscow: Pensoft Publishers.

Thatcher, V. E. (1995). Comparative pleopod morphology of eleven species of parasitic isopods from Brazilian Fish. *Amazoniana*, *13*(3), 305-314.

Thatcher, V. E. (1996). *Braga amapaensis* n. sp. (Isopoda, Cymothoidae), a mouth cavity parasite of the Amazonian fish, *Acestrorhynchus guyanensis* Menezes. *Amazoniana*, *14*(1/2), 121-129.

Thatcher, V. E. (1997). Mouthpart morphology of six freshwater species of Cymothoidae from Amazonian fish compared to that of three marine forms, with the proposal of Artystonenae subfam nov. *Amazoniana*, *14*(3), 311-322.

Thatcher, V. E., Oliveira, A. A. N., & Garcia, A. M. (2009). *Braga cigarra* comb. nov. for *Philostomella cigarra* (Crustacea: Isopoda: Cymothoidae) with a redescription of the species based on specimens from *Galeocharax kneri*, a freshwater fish of Minas Gerais State, Brazil. *Zoologia*, *26*(1), 155-160.

Vieira, I. M. (2006). Inventário biológico da carcinofauna das áreas Sucuriju e região dos Lagos, Amapá. In S. V. Costa Neto (Ed.), *Inventário biológico das áreas do Sucuruju e região dos Lagos no Amapá: Relatório Final Probio* (p. 143-155). Macapá, AP: IEPA.

Received on January 29, 2017.
Accepted on July 31, 2017.