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FREE MEALS ON LONG-DISTANCE CRUISERS: THE VAMPIRE FISH RIDES GIANT CATFISHES IN THE AMAZON

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Abstract - The trichomycterid catfishes known as candirus are renowned for their blood feeding, but information on their habits under natural conditions is very fragmentary and generally restricted to hosts or habitats. We recorded an undescribed species of the vandelliine genus *Paracanthopoma* riding the giant jau catfish, *Zungaro zungaro* (Pimelodidae), in the upper Amazon. The candirus were found on the host's caudal and pectoral fins, as well as the base of the dorsal fin, with their snouts buried up to the eyes in the tough skin of the catfish host. All of them had small amounts of partly digested blood in the distal part of the gut. Along the host's dorsal fin base we found a few additional tiny holes, most of them healed. We suggest that *Paracanthopoma* feeds on the gill chamber of its hosts, and that the individuals we found were taking a ride partly buried into the host's skin. Our assumption seems supported by the widespread behaviour of vandelliine candirus taking blood from the gill region of their hosts, and by a report of *Paracanthopoma parva* found on the gills of another species of giant catfish, *Brachyplatystoma vaillanti*. Additionally, the *Paracanthopoma* sp. individuals we examined were not gorged with blood as usual for several vandelliines. Species within the genus *Paracanthopoma* have the longest and most robust snout, and the longest and strongest dentary teeth among blood-feeding candirus, which fit their drilling needs. Taking a ride on a giant host would be advantageous for *Paracanthopoma* candirus for several reasons: 1) dispersal; 2) no need to search for hosts to feed; and 3) protection from predators. The alternative explanation that *Paracanthopoma* takes blood from the tiny holes it drills in the skin seems unlikely, due to the recent finding that species of the genus *Vandellia* are unable to take blood from their hosts actively and cut open a major branchial artery to gorge themselves with blood due to the host's arterial pressure instead. The body parts of the host the *Paracanthopoma* sp. individuals were attached on have no large vessels that would supply them with plenty of blood. Thus, drilling a hole on a giant host skin seems to serve mostly to anchor the *Paracanthopoma* candirus to their long-distance cruising catfish host. If our assumption holds true, then species of this genus exemplify an instance of phoresis (hitch-hiking) among the blood-feeding candirus.

Key words: *Trichomycteridae*, *Paracanthopoma* sp., *candiru*, *blood-feeding*, *phoresis*, *dispersal*, *Pimelodidae*, *Zungaro zungaro*, *Amazon*.

Resumo - Os bagres tricomicterídeos conhecidos como candirus são famosos por se alimentarem de sangue, mas as informações sobre seus hábitos, em condições naturais, são fragmentárias e restritas aos seus hospedeiros ou ambientes. Registramos uma espécie não descrita de candiru do gênero *Paracanthopoma* (Vandelliinae) sobre um jaú, *Zungaro zungaro* (Pimelodidae), no alto Rio Amazonas. Os candirus estavam sobre as nadadeiras caudal e peitoral e junto à base da dorsal, com seus focinhos enterrados até a altura dos olhos, no tegumento espesso do bagre hospedeiro. Os candirus continham pequenas quantidades de sangue parcialmente digerido na porção distal de seus tubos digestórios. Havia diversos orifícios rasos próximos à base da nadadeira dorsal do hospedeiro, a maioria cicatrizada. Sugerimos que *Paracanthopoma* se alimente na câmara branquial dos seus hospedeiros e que os candirus estejam viajando parcialmente enterrados na pele do jaú. Nossa suposição está apoiada no hábito de tomar sangue na região branquial dos hospedeiros, predominante entre os Vandelliinae, bem como por um registro de *Paracanthopoma parva* sobre as brânquias de uma outra espécie de grande bagre (*Brachyplatystoma vaillanti*). Além disso, os indivíduos de *Paracanthopoma* sp. não estavam empanturrados com sangue, como é usual para Vandelliinae. As espécies de *Paracanthopoma* têm o focinho mais longo e robusto entre os candirus hematófagos, além de dentes mandibulares longos e muito fortes, características adequadas ao hábito de perfurar a pele do hospedeiro. Viajar no corpo do hospedeiro seria vantajoso por diversos motivos: 1) dispersão; 2) não haver necessidade de procurar hospedeiros para se alimentar; 3) proteção contra predadores. A explicação alternativa, de que *Paracanthopoma* toma sangue nos pequenos furos que escava, não parece plausível, devido à recente descoberta de que espécies de *Vandellia* são incapazes de tomar sangue ativamente, pois fazem uma incisão numa das artérias branquiais e valem-se da pressão arterial do hospedeiro para bombear sangue dentro do seu tubo digestório. As partes do hospedeiro, em que os candirus estavam fixados, não têm vasos sangüíneos de calibre adequado para este tipo de alimentação. Portanto, escavar um furo na pele de um hospedeiro deve servir principalmente para ancorar os candirus durante os longos percursos do seu hospedeiro. Caso a nossa sugestão seja plausível, as espécies de *Paracanthopoma* representam um exemplo de forese em candirus hematófagos.

Palavras-chave: *Trichomycteridae*, *Paracanthopoma* sp., *candiru*, *hematofagia*, *forese*, *dispersão*, *Pimelodidae*, *Zungaro zungaro*, *Rio Amazonas*

1. Introduction

Vandelliine trichomycterid catfishes known as candirus are renowned for their blood feeding (Spotte 2002), but very little is known about their habits apart from information on habitat and distribution (de Pinna 1998, de Pinna & Wosiacki 2003). Most species of Vandelliinae seem associated with their host only during feeding, and leave it after filling their stomach (Machado & Sazima 1983, Spotte et al. 2001, de Pinna & Wosiacki 2003, Zuanon & Sazima 2004).

Species in the genus *Paracanthopoma*, however, seem to attach to the body surface of large fish even when not feeding, and de Pinna & Wosiacki (2003) suggest that they cruise along with their hosts for reasons additional to blood feeding. We report here on an undescribed species of *Paracanthopoma* attached to a giant pimelodid catfish in the upper Amazon, and suggest some explanations for this riding.

2. Material and Methods

During a field expedition of the PROVARZEA project of the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) on 6 September 2003, we had the opportunity to examine a giant catfish caught by local fishermen. The fish was caught in the morning with a driftnet in the main channel of the Rio Solimões (0315'S, 67°98'W), near the mouth of the Rio Jutai, Jutai, Amazonas, northwestern Brazil.

Upon a close examination of the catfish, we found three specimens of a vandelliine trichomycterid catfish (candiru) attached to its body. Two individuals of the candiru were maintained alive in a field aquarium with sand bottom for photographic documentation and observations of their behaviour. The three specimens are housed at the fish collection of the Instituto Nacional de Pesquisas da Amazônia (INPA 22729, 22730). Samples of colour transparencies and digital photographs of the candirus and their host are filed in the ZUEC fish photo collection.

3. Results

The giant catfish was identified as a large specimen of the jau *Zungaro zungaro* (= *Paulicea luetkeni*, Pimelodidae) measuring 125 cm in total length (TL) and was still on the boat along with the net (Fig. 1). A careful examination of the fish disclosed three individuals of the vandelliine candiru *Paracanthopoma* sp. n. ("bad-boy") attached to the base of its dorsal fin, as well as to caudal and pectoral fins. The candirus had their snouts buried in the tough skin of the catfish host up to their eyes (Fig. 2), and had small amounts of partly digested blood in the distal part of the gut. The three individuals ranged 27.1-31.7 mm in standard length (SL). Additionally, we found a series of tiny holes drilled in the host's skin, about 2 mm deep and 3 mm wide, along the base of the dorsal fin (Fig. 3). Most of these holes were healed, but one or two seemed fresh.

In the aquarium the two candirus spent the day-time completely buried in the sand, their nocturnal activity being resumed to short and intermittent swimming bouts in the water column followed by their burying in the sand again. They rarely stayed on the sand surface (Fig. 4), quickly burying headfirst with vigorous lateral body movements. An individual of the pelagic auchenipterid catfish *Ageneiosus atronasus* (about 15 cm TL) put in the candiru's aquarium was found one morning with a small shallow hole on the lower flank, similar to those found on the giant catfish ...but no additional blood was found in the candirus' gut.

4. Discussion

We suggest that species of *Paracanthopoma* feeds on the gill chamber of its hosts, and that the attached individuals we found were taking a ride buried into the host's skin but not actually feeding there. Our assumption seems supported by the widespread behaviour of vandelliine candirus taking blood from the gill region of their hosts (e.g., Kelley & Atz 1964, Machado & Sazima 1983, Spotte et al. 2001) and by a report of *Paracanthopoma parva* found on the gills of another species of giant catfish, *Brachyplatystoma vaillanti* (Spotte 2002). Additionally, the *Paracanthopoma* sp. individuals we examined were not gorged with blood as usual for several vandelliines (e.g., Machado & Sazima 1983, Zuanon & Sazima 2004) but had only traces of this food in their digestive tracts. However, the possibility that the candirus would feed on skin mucus while on the giant host cannot be presently ruled out even for the blood-feeding species (see Winemiller & Yan 1989 for this feeding mode in stegophiline candirus).

Species within the genus *Paracanthopoma* have the longest and most robust snout, and the stoutest body among blood-feeding candirus, besides having very long and strong dentary teeth (Spotte 2002, this study). These morphological characters provide the candirus with an apparatus for drilling holes into the tough skin of the catfish host and remaining there firmly attached but still with their eyes out to supposedly scan the surroundings (see Zuanon & Sazima 2004, for visual orientation in *Vandellia* candirus). Thus, the morphology of *Paracanthopoma* seems to lend further support to our suggestion of feeding on the gill chamber and taking a ride on the host's body external surface.

Taking a ride on a giant host would be advantageous for *Paracanthopoma* candirus for several reasons. One of them is dispersal, as giant catfishes engage in long-distance migrations along the Amazon River (Barthem & Goulding 1997). The other is that there would be no need to search for hosts to feed, as they are already riding one (de Pinna & Wosiacki 2003). Finally, protection from predators may be an additional explanation, as the candirus are tiny,



Fig. 1. A giant jau catfish (*Zungaro zungaro*) still on the canoe, being examined for candirus. Note a candiru attached on the middle of the caudal fin.



Fig. 2. *A candiru* (*Paracanthopoma* sp.) with its snout buried into the pectoral fin of the giant catfish *Zungaro zungaro*. Note that the *candiru*'s eyes are exposed.

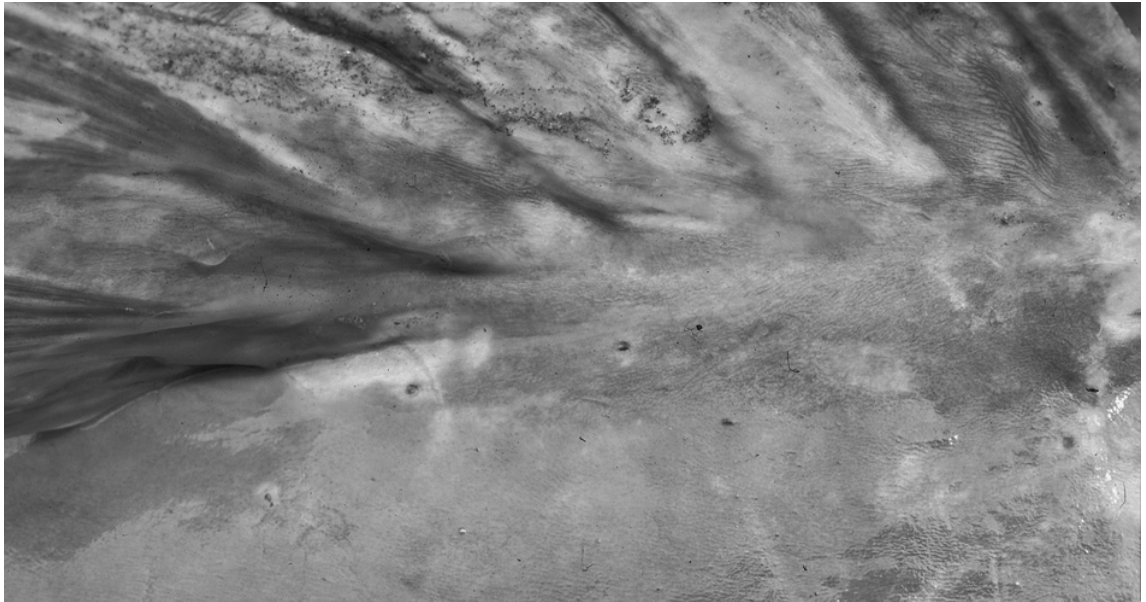


Fig. 3. A series of tiny holes drilled by the candiru *Paracanthopoma* sp. in the giant catfish's skin along the base of the dorsal fin.



Fig. 4. Lateral view of the candiru *Paracanthopoma* sp. in field aquarium. Note the long and sloping snout, stout body, partly digested blood in the distal part of the gut, and fat globules along the abdominal wall.

translucent, and lodged at inconspicuous sites along the gigantic host's body. A free-swimming, blood engorged candiru would be a nutritious meal for small, carnivorous fishes. Preying by characins on blood engorged individuals of the candiru *Paravandellia oxyptera* in the Rio Cuiabá was recorded by IS (pers. obs.).

The alternative explanation that *Paracanthopoma* takes blood from the tiny holes it drills in the skin seems very unlikely, due to the recent finding that candirus are unable to take blood from their hosts actively. Species of the genus *Vandellia* cut open a major branchial artery and gorge themselves passively with blood pumped by the host's arterial pressure (Zuanon & Sazima 2004) and not by any suction mechanism as generally postulated (review in Spotte 2002). The host's body parts the *Paracanthopoma* sp. individuals were attached on have no large vessels that would supply them with enough blood. Thus, drilling a hole in a host's skin seems to serve mostly, if not entirely, to anchor the *Paracanthopoma* candirus to their long-distance cruising giant catfish host. If our assumption holds true, then species of this vandelliine genus exemplify a well-documented instance of phoresis (hitch-hiking) among the blood-feeding candirus, which would explain in part the widespread distribution of some species within this specialised fish group (de Pinna & Wosiacki 2003; JZ pers. obs.). However, the known existence of some still undescribed species of *Paracanthopoma* (M. de Pinna pers. comm.) with more restricted distribution along the Amazon Basin indicates that the association between some of these candiru species and their hosts may be shorter than the long-distance migration taken by the giant catfishes themselves (Barthem & Goulding 1997).

Additionally, we suggest that species of scale and mucus-eating stegophiline candirus of the genera *Stegophilus* and *Parastegophilus* (de Pinna & Wosiacki 2003) are likely candidates for hitch-hiking on their hosts. Our suggestion is supported by the ability of *Parastegophilus paulensis* to attach to a human leg (Guimarães 1935, IS pers. obs.), and clinging there shortly even out of water. The sucker-like oral apparatus, plus the band of tiny, villiform teeth would serve well these clinging needs.

Instead of drilling a superficial hole in the host's skin or clinging mouth-attached on the body, holding to a place within the host's branchial chamber would be another mode of a candiru to ride a large fish. Although there are few, if any evidences for this latter riding mode (review in Spotte 2003) it cannot be entirely ruled out until more of the candiru specialised behaviour is disclosed with further natural history-oriented studies. Thus, fish researchers are urged to pay attention to the presence of these and other candirus when a large fish is caught during their fieldwork.

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