



Rediscovery of the Neotropical water scavenger beetle *Protistolophus spangleri* Short with notes on its habitat and behavior (Coleoptera: Hydrophilidae: Hydrophilinae)

ANDREW EDWARD Z. SHORT^{1,3}, LARISSA SANTANA², CESAR J. BENETTI² & NEUSA HAMADA²

¹Department of Ecology & Evolutionary Biology & Division of Entomology, Biodiversity Institute, University of Kansas, Lawrence, KS 66045, USA.

²Coordenação de Biodiversidade, Programa de Pós-Graduação em Entomologia (PPGEnt), Instituto Nacional de Pesquisas da Amazônia (INPA), Av. André Araújo 2936, CEP 69067-375, Manaus, AM, Brazil.

³Corresponding author. E-mail: aezshort@ku.edu

The water scavenger beetle genus *Protistolophus* Short contains a single species, *P. spangleri* Short, 2010, known from southern Venezuela. The genus was hitherto known only from a single partly-incomplete male specimen, making it one of the rarest and most poorly known aquatic hydrophilid genera in the world. Only one other New World aquatic hydrophilid genus, the Ecuadorian cave endemic *Troglochaeres* Spangler, is known from a single specimen or locality. In a phylogenetic analysis of the Hydrophilini based on adult morphology, the genus *Protistolophus* was resolved as the sister taxon to the remaining genera of the tribe, implying it is an ancient and possibly relict lineage—it possesses a very unusual combination of characters, including a very weakly developed mesoventral keel. It was the only genus not included in a recent molecular phylogeny of the Hydrophilini as no suitable material was available for DNA (Toussaint et al. 2017).

Despite extensive fieldwork for aquatic beetles in Venezuela, Suriname, and Guyana over the last decade, no specimens of *Protistolophus* were collected. It was therefore to our great excitement and amazement when we collected several series of this taxon in a forest reserve in the Brazilian Amazon. These collections allowed us to gain important morphological, ecological, and behavioral information about this isolated lineage of water scavenger beetles.

Protistolophus spangleri Short, 2010

Protistolophus spangleri Short, 2010: 30.

Type Material Examined: Holotype (male): ‘Venezuela. T.F. Amaz./ Cerro de la Neblina/ 1 km S Basecamp/ 0°50’N, 66°10’W/ 140 m., 17 Feb. 1985’, ‘Along small whitewater/ stream; pools of dead leaves & sticks/ P.J. & P.M. Spangler, R. Faitoute, & W. Steiner’, ‘HOLOTYPE/ *Protistolophus/ spangleri/ A.E.Z. Short*’ (deposited in the Museo del Instituto de Zoología Agrícola, Maracay, Venezuela). **New material examined (23): BRAZIL: Amazonas: Manaus:** Ducke Reserve, near Igarapé Acará, 8.ii.2018, detrital pool along creek in forest, leg. Short, Benetti & Santana, BR18-0208-01A (6 exs.); same locality and habitat but 6.vi.2018, leg. Short, BR18-0608-01A (7 exs.); Ducke Reserve, near Igarapé Barro Branco, 9.vi.2018, muddy pools in swampy area adjacent to stream, leg. Short, BR18-0609-02B (4 exs.); Ducke Reserve, 9–10.vi.2018, swampy flooded forest area adjacent to a small creek, leg. Short, BR18-0609-03A (6 exs.). Newly collected specimens are deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA) in Manaus, Brazil and the Snow Entomological Collection (SEMC) at the University of Kansas.

Habitat. The Adolfo Ducke Forest Reserve, 10,000 ha in size, is under the protection of the Instituto Nacional de Pesquisas da Amazônia (INPA). It is located at the border of city of Manaus, at the intersection of the Negro and Amazon Rivers. The first 6 specimens were collected on 8 February 2018 in a detrital pool in the forest that was approximately 3 x 2 m in size and a maximum of 20 cm deep (Fig. 2A). It was less than 20 m from Igarapé Acará [Acara Creek], a swift sandy bottom stream with a few sandstone outcrops. Other taxa in the same pool included the hydrophilid genera *Tropisternus* Solier and *Hydrobiomorpha* Blackburn, as well as the dytiscid genera *Hydaticus* Leach, *Thermonectus* Dejean, *Vatellus* Aubé, and *Copelatus* Erichson. We collected along the margins of Igarapé Acará and several other small detrital pools, as well as large pools that were in the dirt trail leading to the stream from the Ducke Reserve research station, but no *Protistolophus* specimens were found in these habitats.

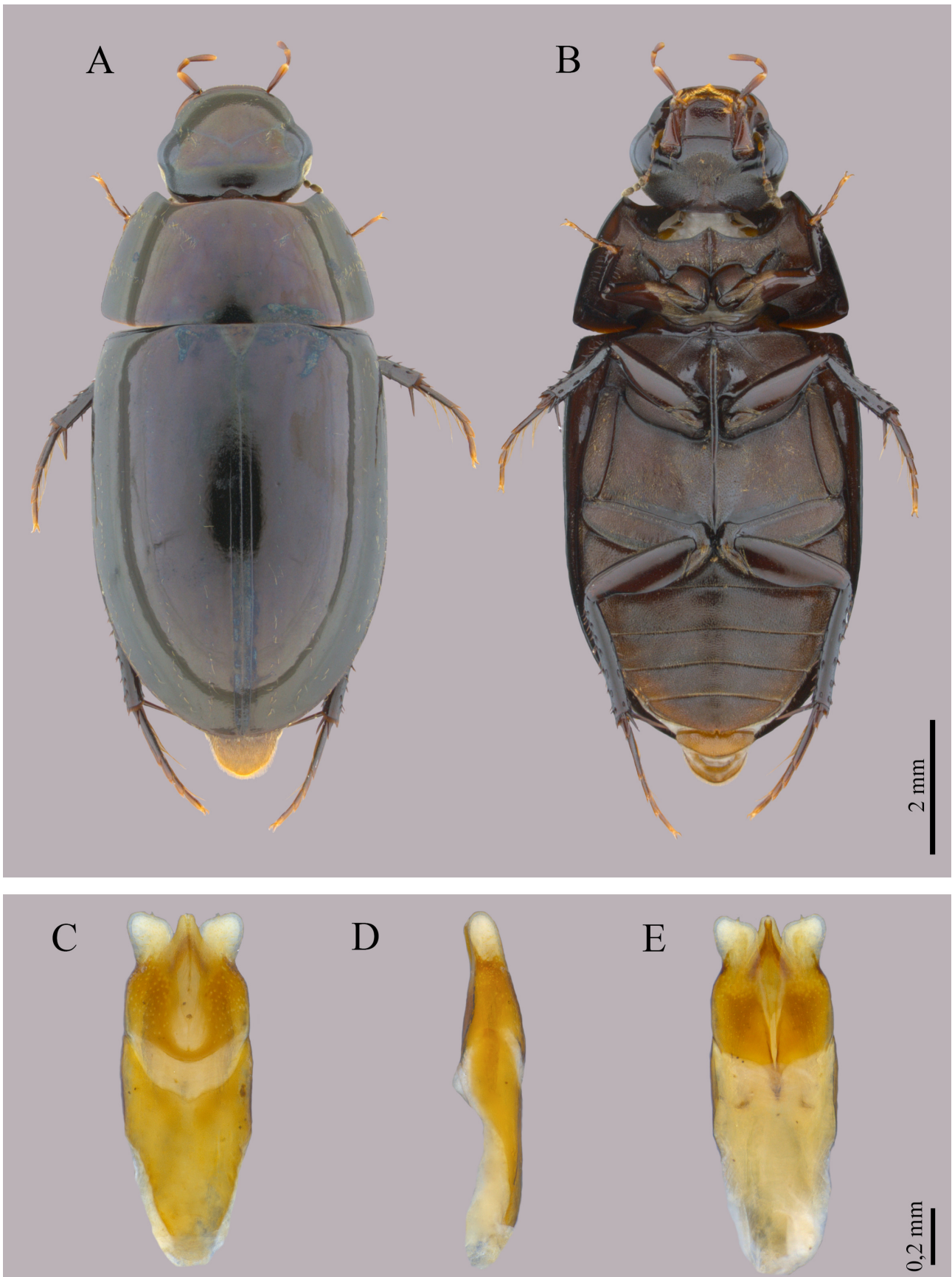


FIGURE 1. *Protistolophus spangleri*, specimen from the Ducke Reserve, Manaus, Brazil. (A) dorsal habitus; (B) ventral habitus; (C) aedeagus, dorsal; (D) aedeagus, lateral; (E) aedeagus, ventral.

We returned to the Ducke Reserve on 5-9 June 2018 and conducted a more comprehensive survey of aquatic beetles. We collected in numerous aquatic habitats, including several streams ranging from rocky to sandy bottoms, artificial roadside ditches and pools, and natural forest pools. We collected 7 specimens of *P. spangleri* in the same detrital pool in which we found specimens four months prior. We also collected 6 specimens in shallow detrital pools (less than 5 cm deep) adjacent to another unnamed stream (Fig 2B). No specimens were collected in the margins of streams, roadside pools, or grassy ditches despite extensive collecting efforts by multiple people over several days. No putative larvae of *Protistolophus* were collected and they unfortunately remain unknown.

The new ecological information is remarkably consistent with the data on the labels of the holotype (“Along small whitewater stream, pools of dead leaves & sticks”). Both the Venezuela and Brazilian collections were made in pristine lowland rainforest in detrital pools that were adjacent to a swift streams.

Behavior. From our 8 February 2018 collecting trip, we kept three specimens alive in a falcon tube and brought them back to the lab where we placed them in a small glass aquarium with leaf and stick detritus taken from the pool in which they were found (Fig. 2D). They lived until 19 February when they were dispatched in ethanol for preservation. The species takes flight relatively quickly when removed from water, as was observed both in the field and in the lab when removed from the tank. While the beetles are able to swim in open water, they do so very clumsily and spent most time clinging to the detritus in the tank. They are excellent crawlers and walk quickly on the substrate in and out of the water with ease. Perhaps most consequential, we discovered *P. spangleri* produces rather loud, audible stridulation. The beetles could be induced to stridulate when by handling them both in and out the water. Stridulation is known in several other lineages of Hydrophilinae, including the closely related genus *Tropisternus* within the Hydrophilini.

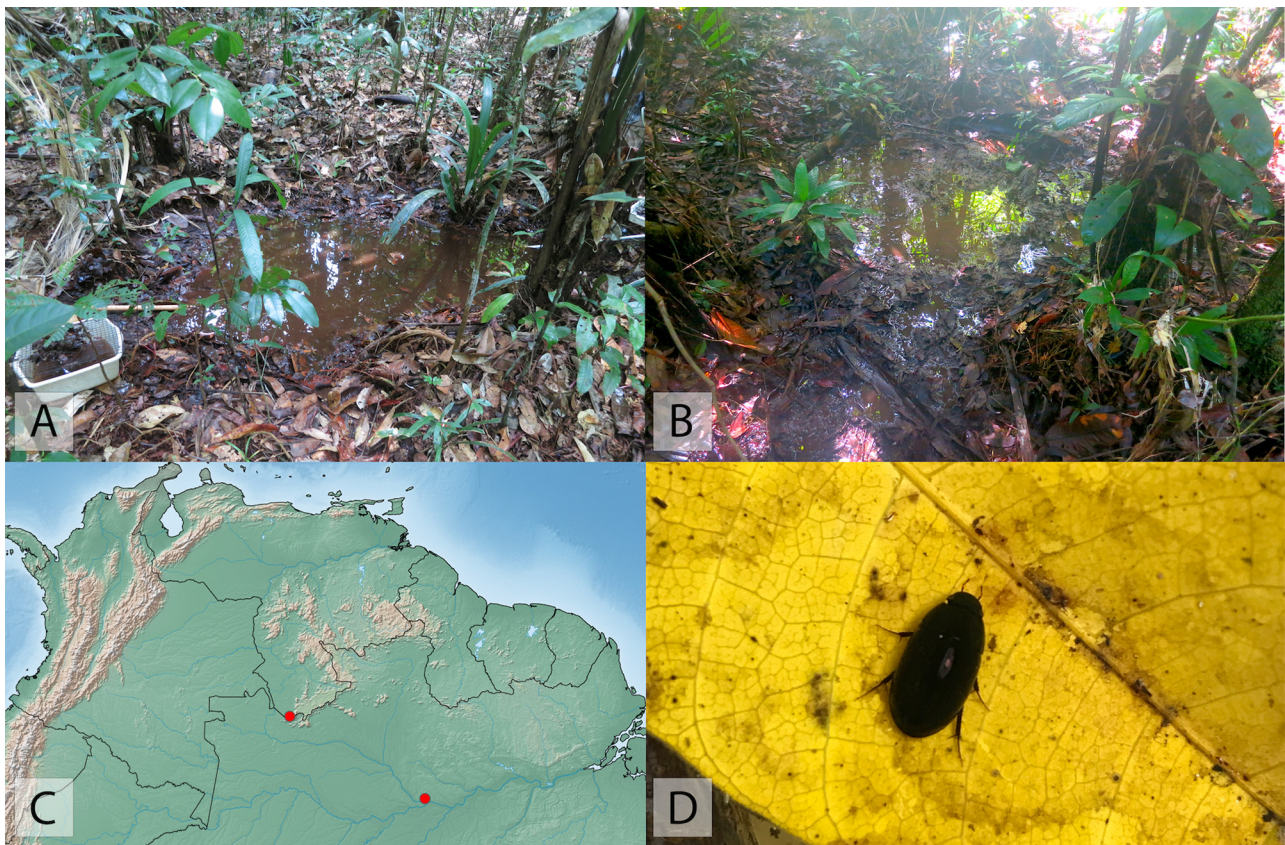


FIGURE 2. Habitat and distribution of *Protistolophus spangleri*. (A) Ducke Reserve, forest pool, collecting event BR18-0208-01A; (B) Ducke Reserve, forest pool, collecting event BR18-0609-03A; (C) Distribution map of the Amazonia region; (D) Live specimen photographed underwater in an aquarium.

We recorded approximately 23 short video clips using an iPhone 6 which cumulatively contain about 15 minutes of footage that documents their swimming and crawling behavior, ability to take flight, and audible stridulation. These videos are available upon request from the first author.

Morphological Notes. The metatarsi were missing in the holotype, and thus we are able to report on their condition here for the first time. The metatarsus contains five tarsomeres, the first being very short, and the second very long—

slightly longer than tarsomeres 3 to 5 combined. The metatarsomeres bear long natatory setae on the dorsal surface, with two rows of short spicules on the ventral surface. Perhaps most notable is that the metatarsi of *Protistolophus* are not rotated laterally as in all other Hydrophilini but remain in the plesiomorphic condition with the ventral surface (with spicules) facing ventrally. We here provide photographs of the male genitalia for the first time (Figs 1C–E).

Remarks. Although these new collections of *Protistolophus* substantially advance our understanding of the genus, the reasons for its apparent rarity remain unknown. Now that the habitat is better understood, it may be easier to locate additional populations in the future. However, forest detrital pools are fairly common in lowland Amazonia and it is puzzling why the species was seemingly easy to encounter at the Ducke reserve at two different times of year but yet not a single individual has turned up elsewhere.

Acknowledgements

This study was supported by US National Science Foundation grant DEB-1453452 and a Fulbright/ CAPES Scholar Fellowship to AEZS and by PROTAX/ CNPq-440616/2015-8; CNPq/MCTI/FAP/PROTAX-FAPEAM (Fundação de Amparo à Pesquisa do Estado do Amazonas) to NH. LS thanks FAPEAM for a PhD fellowship and CAPES for the support to INPA's graduate school; CJB thanks CNPq and FAPEAM for a post-doctoral fellowship (processes 151461/2014-7, 302031/2015-4, 104231/2018-1, and 160666/2019-8). NH is CNPq research fellow (307849/2014-7; 308970/2019-5). Fieldwork was conducted under SISBIO license 59961-1.

References

- Short, A.E.Z. (2010) Phylogeny, Evolution, and Classification of the Giant Water Scavenger Beetles (Coleoptera: Hydrophilidae: Hydrophilini: Hydrophilina). *Systematics and Biodiversity*, 8, 17–37.
<https://doi.org/10.1080/14772000903529375>
- Toussaint, E.F.A., Bloom, D.D. & Short, A.E.Z. (2017) Cretaceous West Gondwana vicariance shaped giant water scavenger beetle palaeobiogeography. *Journal of Biogeography*, 44, 1952–1965.
<https://doi.org/10.1111/jbi.12977>