First report of two little-known aquatic insects in French Guiana and notes on their habitat (Coleoptera, Elmidae; Hemiptera, Potamocoridae)

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- Abstract. Specimens of Pagelmis Spangler, 1981, and Potamocoris Hungerford, 1941, were collected in French Guiana during a hydrobiological survey in a protected area shared between the La Trinité National Reserve and the Amazonian National Park. These Neotropical taxa are seldom collected and are reported here for the first time from this French overseas territory. Habitat information is provided.
- Résumé. Premier signalement en Guyane de deux Insectes aquatiques méconnus et notes sur leurs habitats (Coleoptera, Elmidae ; Hemiptera, Potamocoridae). Des spécimens de Pagelmis Spangler, 1981, et Potamocoris Hungerford, 1941, ont été récoltés en Guyane au cours d'une étude hydrobiologique menée sur une zone protégée à la jonction de la Réserve naturelle nationale de La Trinité et du Parc amazonien de Guyane. Ces deux taxa néotropicaux sont rarement collectés et il s'agit du premier signalement pour le territoire. Des informations sur l'habitat sont fournies.

Keywords. - Pagelmis, Potamocoris, Guiana Shield, Upper Courcibo River, adult, substrate.

French Guiana is a part of the Guiana shield, an old Precambrian geological formation more than 1600 km long, located in the north-eastern part of South America. Bordered by Brazil in the east and south and by Suriname in the west, this French overseas territory of 84,000 km² is 90% covered by tropical rainforest. In this biodiverse and under-surveyed area, aquatic inventories remain particularly incomplete. Improved taxonomic and ecological knowledge of benthic macroinvertebrates is a top priority to develop efficient bioassessment tools and to guide water management decisions regarding preservation and restoration of water quality (CLAVIER, 2017).

With approximatively 1550 species and 152 genera worldwide, Elmidae (riffle beetles) are a diverse and cosmopolitan family of aquatic beetles especially in the Neotropical Region which hosts about one third of this diversity (50 genera, 500 species) (JÄCH *et al.*, 2016; SHORT, 2018; POLIZEI *et al.*, 2020). During about the past decade, Elmidae have been among the best-studied aquatic taxa in French Guiana (PRZEWOŹNY & FERNANDES, 2012; QUENEY, 2012). Recently, they have received increasing attention with the discoveries of new genera and species (BARR, 2018; CLAVIER *et al.*, 2021; POLIZEI *et al.*, 2020; SHEPARD & QUENEY, 2021; BARR *et al.*, 2021) and the publication of a dichotomous key for larval identification (SHEPARD *et al.*, 2020). Although 34 species and 17 genera were reported in the last inventory (Gargominy *et al.*, 2021), recent surveys confirmed the occurrence of additional genera (W. Shepard & S. Clavier, unpublished data).

Pagelmis Spangler, 1981, is one of the more enigmatic genera of elmids. For about 40 years it was considered monotypic and restricted to its type locality in Ecuador where 6000 specimens of *Pagelmis amazonica* Spangler, 1981, were collected at a light. More recently, the genus has been reported from Venezuela (SPANGLER & STEINER, 2005), Suriname (SHORT & KADOSOE, 2012) and Brazil (ALMEIDA *et al.*, 2020). A second species, *Pagelmis mura* Polizei

& Hamada, 2021, was recently described from the Brazilian amazon forest (Amazonas State) and the habitat characterized. But the habitat of *P*.*amazonica* remained unknown because all specimens have been collected at light traps.

Potamocoris Hungerford, 1941, is one of the less known genera of water bugs. It belongs to the family Potamocoridae which has 11 described species restricted to the Neotropical region, three in Central America and eight in South America (HERRERA & SPRINGER, 2014). The known distribution of the genus includes Belize, Costa Rica, Guatemala, Honduras, and Mexico in Central America (POLHEMUS & CARRIE, 2013; HERRERA & SPRINGER, 2014) and a patchy distribution in South America: Brazil (HUNGERFORD, 1942; DE CARLO, 1968; LONGO *et al.*, 2005), Paraguay (HUNGERFORD, 1941), Peru (LA RIVERS, 1969), and Suriname (VAN DOESBURG, 1984). One of the more confusing aspects of this family is the existence of a coleopteroid form. The sclerotized hemelytra that lack the claval suture or embolium gives these true bugs a beetle-like appearance. This characteristic led to the recognition of two genera: *Potamocoris* and *Coleopterocoris* Hungerford, 1942, until 2013 when the latter was determined to be a coleopteriform morph of *Potamocoris* and the two genera were synonymized (POLHEMUS & CARRIE, 2013). Due to its tiny size, occurrence at low densities, and that most of the specimens are from light-trap collections, the ecology of the family is poorly understood.

MATERIALS AND METHODS

Specimens were collected during an eight-day survey and inventory of aquatic macroinvertebrates of the Upper Courcibo River in La Trinité National Reserve and the Parc amazonien de Guyane in French Guiana (fig. 1). This survey was carried out by the environmental studies office ONIKHA during the dry season in November 2019.

Collecting was conducted using a surber net/sampler (500 μ m mesh size) or directly by handpicking the specimens from the substrate. Sampling with the surber net was conducted by disturbing the substratum to a depth of several centimetres to dislodge any macroinvertebrates attached to or buried in the organic and/or mineral substrates.

Water quality measurements were taken with a WTW[™] ProfiLine[™] pH, 3110 meter, WTW[™] ProfiLine[™] Cond 3110 conductivity meter, VWR DO220 dissolved oxygen meter, and ThermoScientific[™] Eutech TN-100 Turbidimeter.

Specimens were stored in a 96% ethanol solution and identified in the lab. Images were made at the UMR EcoFoG (Campus Agronomique de Kourou – French Guiana) with a Leica Z16APO stereo microscope and a Leica camera DC450 fitted with the Leica Application Suite V4.10 and the Helicon focus V7.0 software.

Specimens are stored in the ONIKHA collection (Kourou, French Guiana).

RESULTS

Order Coleoptera Linnaeus, 1758

Family Elmidae Curtis, 1830

Genus Pagelmis Spangler, 1981 (fig. 4-6)

Material examined. – 2 adults, French Guiana, Amazonian National Park / La Trinité National Reserve, Upper Courcibo, 15.XI.2021, 125 m, 4°28'37.5"N 53°13'03.8"W, *S. Clavier* (ONIKHA Collection: COU19AVC1-24). Handpicked from stream.

The specimens of *Pagelmis* were handpicked and stored in a day vial so the exact microhabitat is unknown. However, leaf packs and branches were the most commonly examined substrate so the species probably occurred in them.



Fig. 1-3. – Distribution and habitat of *Pagelmis* Spangler, 1981, and *Potamocoris* Hungerford, 1941, in French Guiana. – **1**, Distribution in French Guiana (red spot: Upper Courcibo River; green area: La Trinité National Reserve; blue area: Amazonian National Park – full protection area; hashed black area: Amazonian National Park – protection area). – **2-3**, Stream habitat: Courcibo River.



Fig. 4-6. – Pagelmis sp., habitus. – 4, Dorsal. – 5, Ventral. – 6, Lateral.

Order **Hemiptera** Linnaeus, 1758 Family **Potamocoridae** Usinger, 1941 *Potamocoris* Hungerford, 1941 (fig. 7-9)

Material examined. -1 3 adult, coleopteroid, French Guiana, National Amazonian Park / La Trinité National Reserve - Upper Courcibo, 15.XI.2021, 125 m., 4°28'37.5"N 53°13'03.8"W, *S. Clavier* (ONIKHA Collection: COU19-05-04). Collected with a surber net/sampler in gravel with current (25–75 cm/s).

HABITAT DESCRIPTION

All the specimens (two adults of *Pagelmis* and one adult of *Potamocoris*) were collected in the upstream portion of the Courcibo River, a preserved mid-order stream in the central part of French Guiana (fig. 1-3). Located between an integral protected area of the National Amazonian Park and La Trinité National Reserve, the drainage area of the upper Courcibo is covered by tropical rainforest and representative of pristine conditions.

The upper Courcibo River is a medium-sized stream (mean width 10 m) in the Sinnamary River watershed at an elevation of about 115 m at the collection site. The stream was shallow (mean depth 1 m) and sand-bottomed with numerous logs and branches in the channel. Leaf





Fig. 7-9. – Potamocoris sp., coleopteroid male, habitus. – 7, Dorsal. – 8, Ventral. – 9, Lateral.

packs and litter patches were located in depositional areas on the banks or trapped on logs in the current. The banks were covered by tropical rainforest and patches of roots from the riparian vegetation were found in the water.

The water was slightly tannin-stained, and the current was generally slow (5–25 cm/s), although with some shallower (30 cm), faster areas (25–75 cm/s) where gravel occurred. Immediately upstream of the collection site was a small cascade with emergent rocks and vegetation. During the eight-day sampling, water quality measurements were taken (table 1). Mean values were: water temperature 25.4 °C, pH 6.3, dissolved oxygen 7.32 mg/L (89%), conductivity 26.9 μ S/cm, and turbidity 3.31 NTU. The *Potamocoris* specimen was collected with a surber sampler (mesh size 500 μ m) in gravel with a fast current (25–75 cm/s) and a depth of about 20 cm.

DISCUSSION

The apparent rareness of *Pagelmis* and *Potamocoris* has been confirmed by our unsuccessful searches for these genera over several years. During the eight-day sampling, 1985 macro-invertebrates were collected, including 278 elmids and 118 Hemiptera. Only two *Pagelmis* and one *Potamocoris* were collected despite intensive sampling in habitat where they occurred. Their tiny size does not account for their low numbers because the smallest taxon, water mites (Hydrachnida), had 15 individuals collected.

Given the limited habitat information known, the information provided here is important, although the exact microhabitat was not determined. Submerged leaf packs and/or branches are probably the preferred microhabitat of *Pagelmis*, although this needs confirmation. Our *Pagelmis* specimens share some mesohabitat characteristics with the recently described *P. mura* —small, undisturbed, slow-flowing Amazonian streams, with black water and sandy streambeds with patches of leaf litter and riparian vegetation roots (POLIZEI & HAMADA, 2021). Due to its rarity and its presence in pristine streams, we suspect the species of *Pagelmis* present in French Guiana to be sensitive to human pressure. This relates greatly to its conservation. It was pointed out in review that our specimens of *Pagelmis* are potentially a new species. Locating additional specimens will aid this determination. If further examination confirms this, the new species will be described in a subsequent paper.

The habitat information for *Potamocoris* obtained here is consistent with that in scarce literature. At the Macaé River in southeastern Brazil, specimens were collected mainly on sandy and gravel substrates (PANIZZI & GRAZIA, 2015). *Potamocoris* is likely less sensitive to human pressures than *Pagelmis* because it has been reported in agriculturally impacted areas

Date (2019)	14.XI	16.XI	17.XI	18.XI	19.XI	20.XI	20.X	21.X
Hour	10 h 45	9 h 00	9 h 15	8 h 15	9 h 30	8 h 08	16 h 45	9 h 00
рН	6,36	6,42	6,13	6,88	6,22	6,15	6,21	6,35
Temperature (°C)	25,6	25,1	25,3	25,2	25,4	25,2	26,5	25,4
Conductivity (µS/cm)	26,6	26,8	26,9	27,1	26,8	27	26,9	27
O ₂ (mg/l)	7,38	7,34	7,36	7,29	7,33	7,31	7,28	7,26
0 ₂ (% Sat.)	89,8	88,7	89,2	88,2	89,1	88,3	90,3	88,3
Turbidity (NTU)	3,16	3,36	2,98	3,69	2,99	3,51	3,48	3,35

 Table I. – Water measurements at the upper Courcibo River. Measurements are missing for 15.XI.2019 and taken two times the 20.XI.2019 —early morning and end of the afternoon.

in Costa Rica (HERRERA & SPRINGER, 2012). This differs from our collection in a pristine stream in French Guiana. The specimen we collected has no apparent claval suture in the hemelytra but does have the sexually dimorphic heavy patch of yellow setae on the posterior edge of the mesofemora and mesotibiae (POLHEMUS & POLHEMUS, 1982). Consequently, we identified it as a coleopteroid male. However, it could not be associated with any known species. The geographically closest species, *Potamocoris nieseri* (Van Doesburg, 1984), found in Suriname, is known only from the female holotype. Because our specimen shares some attributes of *P. nieseri* (e.g., fourth antennomere longer than third), it could be the male of *P. nieseri*; but its small size (body length from apex of head to apex of hemelytra: 1.84 mm) and the interocular space / eye width ratio (narrowest point: 3.15, widest point: 3.89) argue for association with *P. nelsoni* (LONGO *et al.*, 2005), which is known only from Rio de Janeiro. More specimens are needed to confidently make a species identification.

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