

# First report of *Protosialis* Weele, 1909 in French Guiana [Megaloptera, Sialidae]

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Keywords: Megaloptera, *Protosialis*, larva, French Guiana, Neotropics.

During a hydrobiological study conducted at a gold mine in French Guiana, a larva of an alderfly of the Neotropical genus *Protosialis* was collected, that had not before been recorded in this French overseas territory. *Protosialis*' known area of distribution now extends from the Amazon Basin into the Guiana Shield.

## Première citation de *Protosialis* Weele, 1909 en Guyane française (Megaloptera, Sialidae)

Mots-clés : Mégaloptères, *Protosialis*, larve, Guyane, Néotropical.

Au cours d'une étude hydrobiologique menée sur une mine d'or en Guyane française, une larve de mégaloptère identifiée comme appartenant au genre néotropical *Protosialis* a été récoltée. Ce genre n'a jamais été cité auparavant de ce département français d'outremer. Son aire de répartition connue s'étend désormais au Plateau des Guyanes.

## 1. Introduction

The Guiana Shield is an old Precambrian geological formation more than 1600 km long, located in the north-eastern part of South America that underlies Guyana, Suriname, French Guiana, and part of Brazil (Amapá State to the west of the Amazon River). French Guiana (2°- 6° North latitude) stretches over almost 84,000 km<sup>2</sup>. It is a hot spot of biodiversity as 80% of its territory is covered by tropical rain forest, which is considered one of the last 15 clusters remaining worldwide only partially affected by human activity (GARGOMINY 2003; HAMMOND 2005).

Megaloptera ("megalo"= large + "pteron" = wing) is a small and primitive order of holometabolous insects comprised of approximately 340 species worldwide (NEW & THEISCHINGER 1993; COVER & RESH 2008). Recent classifications (e.g., PENNY et al. 1997) consider Megaloptera a separate order from Neuropterera and divide it into two distinct families: Sialidae (alderflies) and Corydalidae (dobsonflies and fishflies). The Neotropical fauna of Megaloptera consists of 73 species and subspecies (CONTRERAS-RAMOS 2007): 63 species of Corydalidae (54 species

of Corydalinae, 9 species and subspecies of Chauliodinae) and 10 species of Sialidae. The Mexican border with the United States is considered to be the northern limit of the Neotropical Region (CABRERA & WILLINK 1980). Five species of Corydalidae have been recorded in French Guiana (CONTRERAS-RAMOS 2007), but there are no records of Sialidae prior to this report. Therefore, the aim of this communication is to record, for the first time, the presence of the family Sialidae (genus *Protosialis*) in French Guiana. This discovery increases the number of Megaloptera species known in this French overseas department to six, from two families, and extends the distribution area of *Protosialis* to the Guiana Shield.

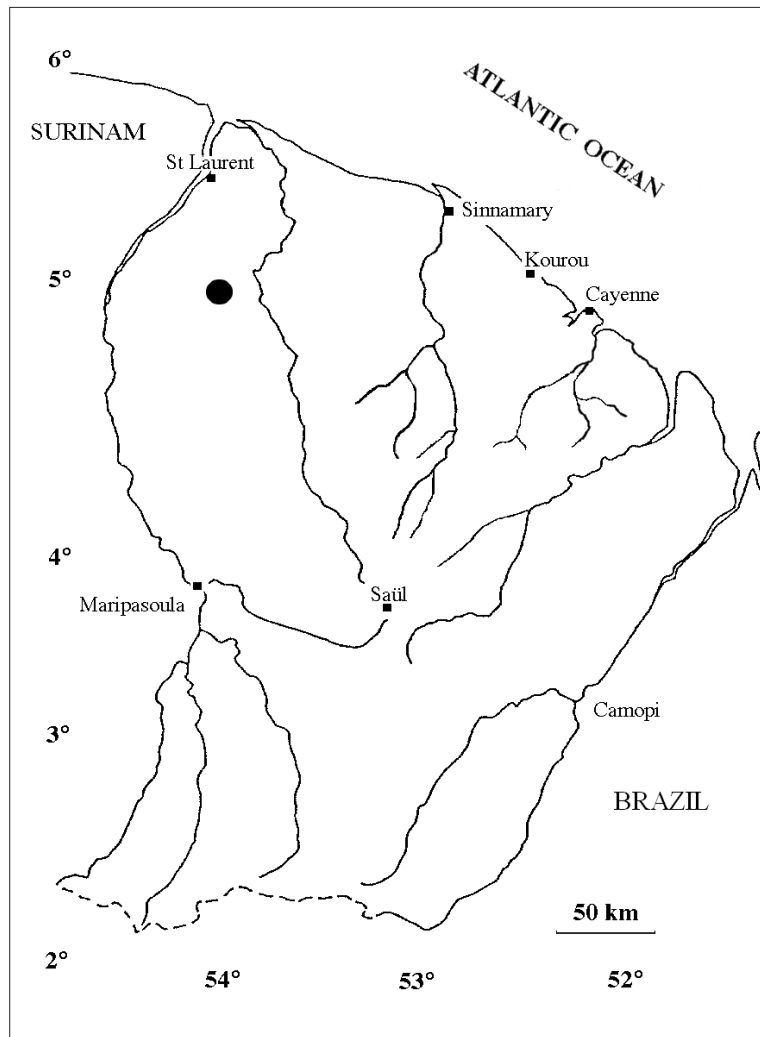


Figure 1. Location of study site.

Figure 1. Carte montrant l'emplacement du site étudié.



Figure 2. Ventral view of Guianese *Protosialis* specimen.

Figure 2. Vue ventrale d'un spécimen guyanais du genre *Protosialis*.

## 2. Material and Methods

Under the auspices of the regional office of the French Ministry in charge of environmental questions (DIREN Guyane), a hydrobiological study was conducted by the HYDRECO Laboratory at the beginning of the dry season (01-IX-2010) at a gold mine (the Saint-Pierre Mine, Boulanger Company) in French Guiana. The study site is located in the town of Mana (Fig. 1). The main goal was to assess the benthic macrofauna. According to ROSENBERG & RESH (1993), "benthic" implies "bottom-living" and the prefix "macro" indicates that these organisms can be caught using nets with a mesh width of 200–500  $\mu\text{m}$ . Sampling was conducted by sweeping a net along the edge of a small stream. The substratum was disturbed to a depth of several centimetres to dislodge any macroinvertebrates attached to or buried in the organic and/or inorganic matter located there.

## 3. Results

One live *Protosialis* larva (Fig. 2) was collected from the soft substrate (mud-litter) of a small, clear tributary (04° 50' 53'' N, 53° 51' 32'' W) of the Saint-Pierre River, which is located in the Mana watershed. The water was rather warm (24.6°C), acidic (pH = 6.89), clear (turbidity

= 10.2 NTU), poorly mineralized (conductivity = 38  $\mu\text{S}/\text{cm}$ ), and had a moderate dissolved oxygen level (dissolved oxygen = 67 %). The immature alderfly was fixed in an ethanol solution (75%) and the voucher specimen has been deposited in the private collection of the HYDRECO Laboratory (French Guiana).

Larval instars of *Protosialis* are difficult to identify because they have so few specific morphological traits. Without an adult association, at this time it is only safe to identify this specimen to genus. All Neotropical alderflies are considered to belong to *Protosialis*, so family diagnostic traits would also determine the genus (FLINT et al. 2008): abdomen with a single long caudal filament (Fig. 3), anal prolegs absent (Fig. 2), and abdominal segments 1–7 with pairs of 4- to 5-segmented lateral filaments.



Figure 3. Dorsal view of the posterior abdomen of Guianese *Protosialis* specimen.

Figure 3. Vue dorsale de l'extrémité de l'abdomen d'un spécimen guyanais de *Protosialis*.

## 4. Discussion

Like the Ephemeroptera, Odonata, Plecoptera and Trichoptera, the Megaloptera have an entirely aquatic larval stage. Megalopteran larvae are generalist predators, occupy a variety of niches, and act as important links in aquatic food webs. Some species might be useful as biological indicators of water quality. In French Guiana, Corydalidae larvae only occur in natural clear streams with a high level of dissolved oxygen and no significant anthropogenic pressure. They are generally collected from stony substrates. In this study, *Protosialis* was also found in a clear water stream. A large number of samples were taken from the area near the gold mine, yet the only specimen found was collected from a small, clear stream with a low level of perturbation. In terms of bioindication, *Protosialis* appears to be a sensitive taxon, but less sensitive than the Corydalidae considering the moderate concentration of dissolved oxygen and the selectivity it demonstrates for substrates. It was found in a soft substrate (mud-litter), which is very frequent in French Guiana. This appears to be the general habitat for larval alderflies, as Nearctic *Sialis* have been recorded to prefer soft substrates (i.e., mud, silt, detritus) with accumulations of plant debris (CANTERBURY 1978), where they feed on small animals, such as insect larvae, annelids, crustaceans, and mollusks (FLINT et al. 2008).

The megalopteran family Sialidae contains seven genera and approximately 81 species (NEW & THEISCHINGER 1993; COVER & RESH 2008). Only *Sialis* and *Protosialis* are found in the New World (PENNY 1993). The status of the genus *Protosialis* is debatable and needs a taxonomic revision (CONTRERAS-RAMOS et al. 2005). Its exact phylogenetic position is uncertain, as no phylogeny has yet been proposed for Sialidae; however, like PENNY (1977 and 1981), CONTRERAS-RAMOS (2006) justified validity and usage of *Protosialis* based on morphological characters, and the use of this taxon name is thus adopted herein.

The 10 recorded Neotropical alderfly species occur in Cuba, Mexico, Panama, Colombia, Venezuela, Peru, Bolivia, Brazil, Chile, and Argentina (FLINT 1973, PENNY 1981, AZEVÊDO 2003, CONTRERAS-RAMOS et al. 2005, CONTRERAS-RAMOS 2006 and 2007). With this discovery, the known distribution of *Protosialis* is now expanded to include the Guiana Shield (Fig. 3). The closest reported site for *Protosialis* is the area around Manaus in Brazilian Amazonia, where *P. flammata* Penny has been recorded (AZEVEDO 2003). This implies an extension of the range of distribution for *Protosialis* by at least 1100 km, and the possibility that *P. flammata* is the species present in French Guiana.

Although the taxonomy of Neotropical megalopterans has recently reached a satisfactory level of knowledge (CONTRERAS-RAMOS 1999), Sialidae is the least studied group due to its rarity and the patchy distribution of the populations. Moreover, most species of Neotropical sialids are unknown in their larval stage. This study points to new biological material of potential taxonomic and ecological interest. It would be pertinent to conduct a black-light sampling of adult specimens, as well as to rear specimens from larvae, in the habitat studied. However, the inaccessibility of the present study site (by helicopter only) is a limiting factor for biosurveys; yet similar, perhaps more easily accessible habitats might also prove rewarding.

### Acknowledgements

S. C. is grateful to DIREN Guyane, to the Boulanger Company, to the HYDRECO team and especially Mathieu Rhoné for sorting the specimen during the sampling analysis, to Dr Alain Thomas for his guidance and availability, and to Mrs Andrea Dejean for her English review.

## References

- AZEVÊDO, C. A. S. 2003. *Taxonomia e bionomia de imaturos de Megaloptera (Insecta) na Amazônia Central, Brasil*. M. Sc. thesis, Instituto Nacional de Pesquisas da Amazônia, Universidade Federal do Amazonas, Manaus.
- CABRERA, A., & A. WILLINK. 1980. Biogeografía de América Latina. *Organización de los Estados Americanos, Monografías Científicas, Ser. Biología*, **13**: 1-122.
- CANTERBURY, L.E. 1978. *Studies of the genus Sialis (Sialidae: Megaloptera) in eastern North America*. Ph.D. Dissertation. University of Louisville, Louisville, Kentucky. 93 pp.
- CONTRERAS-RAMOS, A. 1999. List of species of Neotropical Megaloptera (Neuropterida). *Proceedings of the Entomological Society of Washington*, **101** (2): 274-284.
- CONTRERAS-RAMOS, A. 2006. *Protosialis ranchograndis*, a new species of alderfly from Venezuela, with a redescription of *P. brasiliensis* Navás (Megaloptera, Sialidae). *Proceedings of the Entomological Society of Washington*, **108** : 977-984.
- CONTRERAS-RAMOS, A. 2007. Recent accounts on the systematic and biogeography of Neotropical Megaloptera (Corydalidae, Sialidae). *Annali del Museo civico di Storia naturale di Ferrara*, **8**: 67-72.
- CONTRERAS-RAMOS, A., G. L. FIORENTIN & Y. URAKAMI. 2005. A new species of alderfly (Megaloptera, Sialidae) from Rio Grande do Sul, Brazil. *Amazoniana*, **18** (3/4): 267-27.
- COVER, M. R. & V. H. RESH. 2008. Global diversity of dobsonflies, fishflies, and alderflies (Megaloptera, Insecta) and spongillafly, nevrorthids, and osmylids (Neuroptera, Insecta) in freshwater. *Hydrobiologia*, **595**: 409-417.
- FLINT, O. S. Jr. 1973. The Megaloptera of Chile. *Revista Chilena de Entomología*, **7**: 31-45.
- FLINT, O. S. Jr., E. D. EVANS & H. H. NEUNZIG. 2008. Megaloptera and aquatic Neuroptera. Pp 425-437 in *Aquatic Insects of North America*, R.W. Merritt, K.W. Cummins & M.E. Berg (eds), 4th edition Kendall/Hunt, 425-437. *Dubuque*.
- GARGOMINY, O. 2003. *Biodiversité et conservation dans les collectivités françaises d'outre-mer. Collection Planète Nature*. Comité français pour l'UICN, Paris, France. 246 pp.
- HAMMOND, D. S. 2005. *Tropical Rainforests of the Guianan Shield*. CABI Publishing, Wallingford, United Kingdom. 560 pp.
- NEW, T. R. & G. THEISCHINGER. 1993. Megaloptera (Alderflies, Dobsonflies). *Handbuch der Zoologie*, Vol. **4** (Part 33). Walter de Gruyter, Berlin. 97 pp.
- PENNY, N.D. 1977. Lista de Megaloptera, Neuroptera e Raphidioptera do México, América Central, ilhas Caraibas e América do Sul. *Acta Amazonica*, **7** (4): Suplemento, 61 pp.
- PENNY, N. D. 1981. Neuroptera of the Amazon Basin. Part 4. Sialidae. *Acta Amazonica*, **11**: 843-846.
- PENNY, N. D. 1993. The phylogenetic position of *Chloroniella peringueyi* (Megaloptera, Corydalidae) and its zoogeographic significance. *Entomological News*, **104**: 17-30.
- PENNY, N. D., P. A. ADAMS & L. A. STANGE. 1997. Species catalog of the Neuroptera, Megaloptera, and Raphidioptera of America North of Mexico. *Proceedings of the California Academy of Sciences*, **50**: 39-114.
- ROSENBERG, D. & V. RESH. 1993. *Freshwater Biomonitoring and Benthic Macroinvertebrates*. Chapman Hall Publisher, 512 pp. *New-York, London*.