

# Mayflies of West Africa: the Adults of the Subgenus *Adenophlebiodes* s.s. (Ephemeroptera: Leptophlebiidae)

by

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In West Africa, the subgenus *Adenophlebiodes* s.s. comprises five species divided into two groups: *A. (A.) ornatus* (Ulmer), *A. (A.) massirius* sp. n. and *A. (A.) adrieni* sp. n. for *A. (A.) ornatus* group, *A. (A.) rubeus* sp. n. and *A. (A.) callasae* sp. n. for *A. (A.) decoratus* (Navás) group. One of these species, *A. massirius*, is widely distributed from Guinea to Togo and is found in plains as well as at medium altitude, in savanna and in forest areas; the other species are less widespread. In the area of our study, *A. (A.) decoratus*, known from Central Africa has not been recorded. In the same way, we did not find *A. (A.) bicolor*, the presence of which in West Africa seems therefore unlikely. This species belongs to the *A. decoratus* group. Examination of the specimens and the existing descriptions make it possible to establish a key to the species.

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## INTRODUCTION

In West Africa, four genera of Leptophlebiidae are represented: *Adenophlebia* (in Guinea: Verrier, 1958; Elouard and Gillies, pers. comm.), *Thraululus* and *Choroterpes* (Elouard leg.) as well as *Adenophlebiodes* (Côte d'Ivoire: Verrier, 1951 and Ghana: Peters and Edmunds, 1964).

This work is part of a study of light-trap collections of Ephemeroptera carried out in Côte d'Ivoire, Mali, Togo, Ghana, Sierra Leone, Guinea, and Senegal (Fig. 1) by members of the ORSTOM Hydrobiology Laboratory in Bamako<sup>1</sup>. Among previous papers have been those on *Eatonica* (Elouard, 1986a), *Afromera* (Elouard, 1986b), *Exeuthyplocia* (Hideux, 1987) and *Machadorythus* (Elouard and Gillies, 1989). The present work concerns the subgenus *Adenophlebiodes* (*Adenophlebiodes*) Ulmer.

1. This work is financed by a technical service agreement between the Onchocerciasis Control Programme and ORSTOM (Institut Français de Recherche Scientifique pour le Développement en Coopération) as part of the ecological monitoring of the rivers treated with antiblackfly insecticides.

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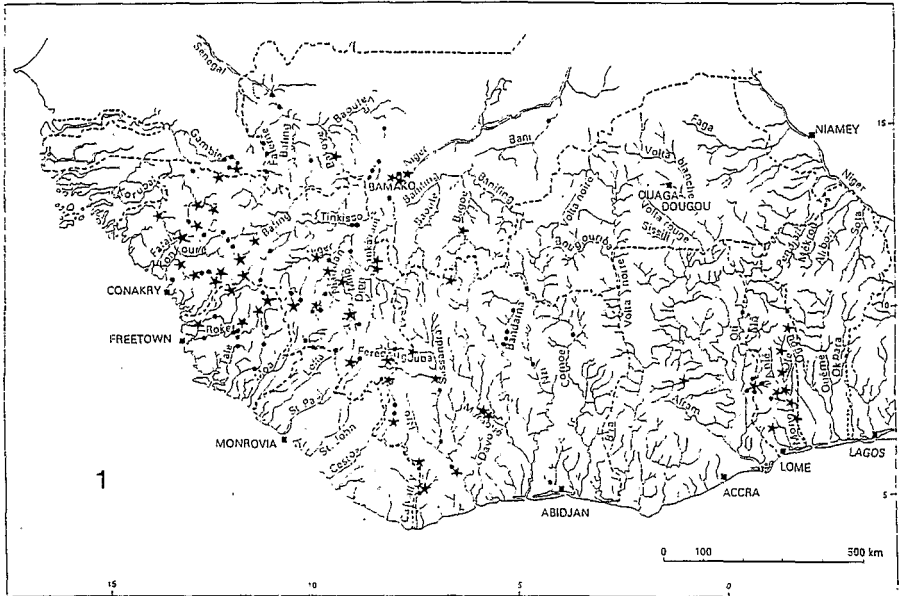


Fig. 1. Map of the light traps operated by ORSTOM hydrobiological laboratory in Bamako. Presence (\*) or absence (•) of *Adenophlebiodes massirius* indicated.

#### TAXONOMIC STATUS OF THE LEPTOPHLEBIIDAE *ADENOPHLEBIODES* S.L.

*Adenophlebiodes* was created by Ulmer (1924) for the species *A. ornatus* from Cameroon, which he had formerly placed in *Adenophlebia* Eaton. In 1955 Demoulin divided the genus into two subgenera: *Adenophlebiodes* s.s. and *Hyalophlebia* Demoulin. This division was based in the adult on certain venational characters and on the presence of pigment in the wing of *Adenophlebiodes* and its absence in *Hyalophlebia*. Demoulin also listed a number of nymphal characters that he considered as diagnostic of the two subgenera. Peters and Edmunds (1964) showed that only the presence or absence of pigmented wings served to differentiate the adults of the two groups. They also showed that the nymphal characters segregated into two categories but concluded that there was not enough evidence from nymphal/adult associations to prove the congruence of nymphal and adult groupings. They also confirmed the action of Edmunds (1953) in synonymizing the South African genus *Euphlebia* Crass with *Adenophlebiodes*. By the time Demoulin's overall account of the Ethiopian Ephemeroptera appeared in 1970 no further information was recorded and Demoulin noted that the validity of the two subgenera remained provisional. The situation is still the same, and in this paper we follow Demoulin in basing the identification of *Adenophlebiodes* s.s. on the possession of pigmented wings alone.

The adults of the genus *Adenophlebiodes* have the following characteristics (Peters and Edmunds, 1964):

- The minimum and maximum measurements are: length of the body 7.0-8.5 mm (male) and 5.0-11.0 mm (female), length of the fore wing 7.0-9.0 mm (male) and 7.5-15.0 mm (female).
- In males the dorsal eyes touch each other at the epicranial suture or are separate by a width, which is at most equal to the width of lateral ocellus. In females, the space between the two eyes is three and a half times the maximum width of one eye.
- Fore wing vein Rs forks up to one-fifth of the distance from the base to the extremity of the wing, vein MA, up to half this same distance, MA1 and MA2 are symmetrical; vein MP splits at the same distance from the base as Rs; MP1 and MP2 are asymmetric. The cubital field has two intercalaries, the crossveins are numerous. The costal projection of the hind wings is rounded and well developed, the apex is located halfway from the base. The crossveins are numerous.
- The claws are similar and apically hooked, each with an opposing hook.
- In males, the base of the forceps is large, their inner margin presents an angle, segments two and three are short. The penes are divided, their extremity is pointed and curved towards the interior. In females sternite IX may present an apical slope. The terminal filament is slightly longer than the cerci.

#### SPECIES OF THE SUBGENUS *ADENOPHLEBIODES* S.S.

Demoulin listed four named species in 1970: *A. (Adenophlebiodes) ornatus* (Ulmer, 1924), *A. (A.) bicolor* (Crass, 1947), *A. (A.) decoratus* (Navás, 1931a and b) and *A. (A.) masonellus* Agnew, 1961, known from the adult stage. He also listed three unnamed nymphs that appeared to belong to the subgenus. Apart from *A. ornatus* from Cameroon the only other record from West Africa is that of *A. bicolor* from Côte d'Ivoire identified by Verrier (1958). We add here four new species, *A. (A.) massirius*, *A. (A.) adrieni*, *A. (A.) rubeus*, and *A. (A.) callasae*.

Differentiation of the terminalia at the species level is not well marked in *Adenophlebiodes*. Definitions of species are therefore mainly based on colour patterns, particularly the distribution of pigment in the fore wings. The adults of *Adenophlebiodes* can be separated into two groups, depending on the extent of the pigmentation of the fore wings. In the *A. ornatus* group this is restricted to interrupted bands or patches of pigment mainly in the basal half of the forewing. Included in this group are *A. massirius*, *A. adrieni*, and the south African *A. masonellus*. In the second group, which includes *A. decoratus*, *A. bicolor*, *A. rubeus* and *A. callasae*, the basal half of the forewing is almost completely pigmented.

#### 1. *A. ORNATUS* GROUP

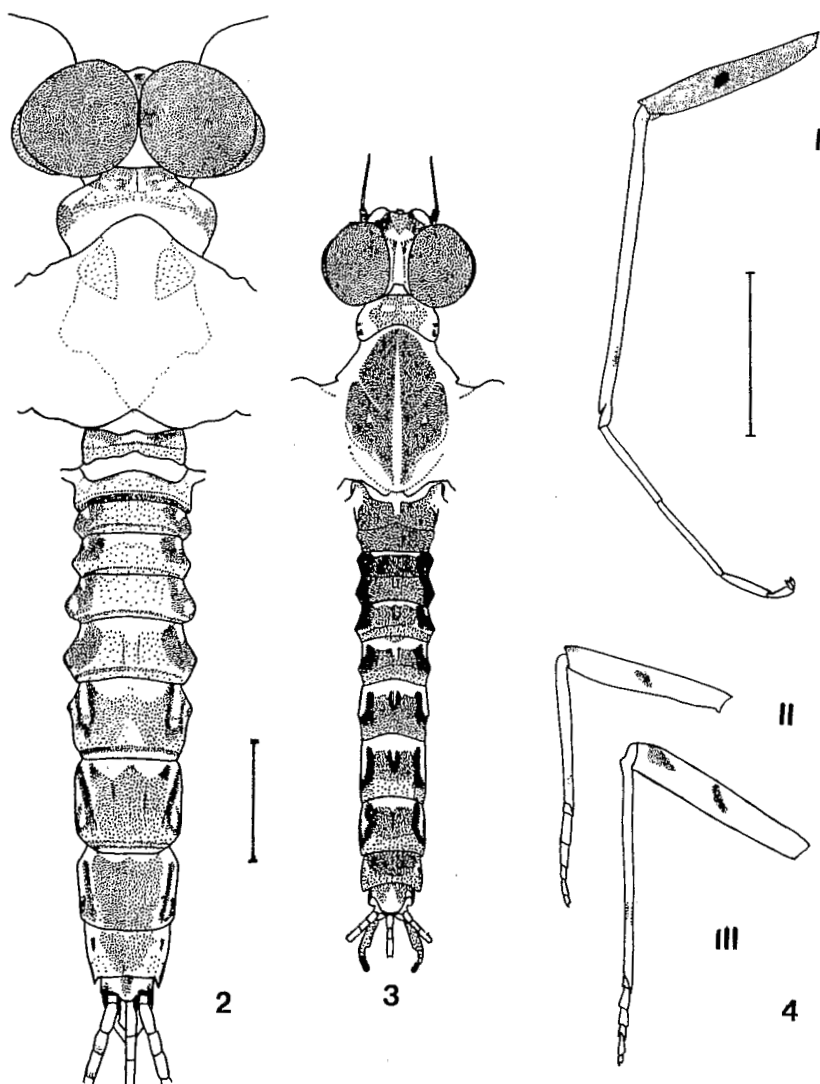
##### *Adenophlebiodes (Adenophlebiodes) ornatus* (Ulmer, 1916)

*Adenophlebia ornata* (Ulmer, 1916). Arch. für Naturg., 81(A), (1915): 13.

*Adenophlebiodes ornata* (Ulmer, 1924). Konowia, 3 : 33.

It is the type species of the genus. Its body length is 7 mm. Some variations will be noted in the descriptions; they concern the colour of the prothorax and the

abundance of spots on the fore and hind wings. A general aspect of the male subimago (Fig. 2) and in particular, a representation of its wings (Figs. 8, 9) is given. The imagines examined have been collected many years ago, so the coloration of the wings (Figs. 10, 11) is probably paler than in fresh specimens. Genitalia of males are represented in figure 12. The length of this specimen is 8 mm.



Figs. 2 - 4. Male imagines of *Adenophlebiodes* spp., habitus in dorsal view (2, 3) and legs (4); 2, *A. ornatus*, 3, 4, *A. massirius*. Scale lines are 1 mm long.

*A. ornatus* is known from Cameroon, (Ulmer 1916), Côte d' Ivoire (as *delamarei*, Verrier, 1951; Puthz, 1971), Uganda (Kimmins 1960, Corbet, 1961) and Zaïre (Elouard leg.).

In our present study, this species has been found in Guinea, in the basins of Rio Corubal, Moa (= Makona), Cavally, and in Côte d' Ivoire in the Sassandra Basin (Fig. 17). According to its distribution, it seems to be a forest species; it is absent from the great savanna rivers (Niger, Senegal), even in their upper course in Guinea.

*Specimens studied*: Rio Corubal Basin, on a tributary of the Tomine River (= R.) at 35 km to the north of Telimele (Guinea), 27/1/87, 2 ♂ subimagines (s.i.). Moa (= Makona) R. at Bofossou, 29/1/88, 1 ♂ s.i. Cavally Basin, in Guinea, on a small tributary, to the north-west of Mount Nimba 1/II/88, 1 ♀ s.i., on the Cavally R., at Oueyakole (Mount Nimba region) 2/II/88, 1 ♂ s.i. Sassandra Basin, on Feredougouba R. at Badala (Côte d' Ivoire) 30/III/85, 1 ♂ S.I. On Mount Hoyo (Zaire) 17/II/81, 1 ♀ s.i. Banco R. (Côte d' Ivoire, Verrier's collection) 1 ♂ imago (i.) 9/VIII/45, 1 ♂ i. 13/VIII/45.

#### ***Adenophlebiodes massirius* sp.n.**

*Male imago* (Fig. 3). Head: the background colour is light yellow with grey spots. The orange-coloured dorsal eyes do not touch and the shortest distance between the two is roughly equal to the width of one lateral ocellus. The ventral eyes, blackish-grey, are visible dorsally. The base of the ocelli is pigmented greyish-brown. The base of the antennae is brown, the flagellum is slightly clearer.

Thorax: dorsally, the prothorax shows a greyish-brown area, enclosing two whitish symmetrical spots. The mesothorax is of a quite light brown colour, the metathorax the same but a different shade.

The fore wings are hyaline with an opaque band between the veins C and Sc and reddish-brown spots on the basal half of the wing. This pigmentation is limited around some crossveins or may spread as spots (areas of MP-MP1-MP2, Rs-R1-R2, ICu). The extent of this colouring is variable. The wing represented in figure 18 is a well-marked wing but examination of other specimens shows that there may be a reduction of the extent of pigmentation, which is then limited to a few spots on the fore area of the basal part of the wing (Fig. 20). The hind wings (Fig. 19, 21) are also hyaline, the crossveins between the costa and the subcosta are sometimes pigmented reddish-brown. Likewise, sometimes a spot is found on the basal part of the wing as well as a pigmented zone at the apical margin of wing.

The fore femur is brown with a darker median spot, the tibia is light yellow, with a faint brownish grey area on the distal part, the first segment of the tarsus is fused with the tibia (Fig. 4). The ornamentation of the middle and hind legs is identical: the background colour of all segments is light yellow, the coxae and the femora show two brownish-grey spots, the tibiae are identical to those of fore legs. The tarsi are composed of five segments, the claws are identical.

Abdomen: from a dorsal view, the abdomen is abundantly covered by very dark brownish-grey spots on a yellowish background. Segment I is uniformly coloured, each of segments II to VIII possesses a median spot and two darker lateral spots. Segments VII, VIII and IX are slightly different, segment X has a spot which forms a complete W. Ventrally, the abdomen is yellowish-white with long brownish-grey spots laterally. The forceps have a medium greyish-brown colour from the base to the apex. The penes are yellowish-white (Fig. 15). The cerci and the terminal filaments are white with rings not very brownish.

The length of the body and that of the fore wing of *A. massirius* are 5.5-6.0 mm. *A. massirius* is the smallest of the species encountered.

*Female imago.* The eyes are blackish-grey. The thorax is identical to that of the male, sometimes clearer, the colouring of the fore wing is often more extensive than for the male; a greater number of crossveins are coloured, the spots are more numerous, and more extensive (Fig. 22). Hind wings hyaline with reddish brown spots on basal part and a pigmented zone at the apical margin (Fig. 23). The legs are identical to those of the male. The abdomen is often more pale than in the male. The subanal plate is not split. The female is of the same size as the male.

*Subimago.* The correspondence between the subimago and the imago has been obtained after the moult of subimagines caught with light traps. The basal half of the fore wing has an opaque background, the margins of the cells are outlined in brown, some darker spots mark the places where spots are found in the adult. An opaque transverse band, with irregular contours, separates the basal half from the apical half. The background of the latter is coloured light brown, the margins of the cells are opaque (Fig. 24). Hind wing: apical part light brown (Fig. 25). The other parts of the body of the subimago are identical to those of the imago.

#### *Comparison between A. massirius and A. ornatus*

*A. massirius* is very widespread in West Africa. It is curious that it has not been reported previously. Its morphological affinity to *A. ornatus* (colour of wings) makes us think that they were confused one with the other. However, they differ in many ways, the most important of which are the following:

- the dorsal eyes of *A. ornatus* are contiguous or very close, those of *A. massirius* are well separated;
- the fore femora are brown for *A. massirius* and whitish with a brownish spot for *A. ornatus*;
- the colouring of the wings of *A. massirius* is markedly less extensive than that of *A. ornatus*, even for the better endowed specimens (furthermore, the wing of *A. ornatus* is traversed from the anterior margin to the posterior margin by a continuous coloured band, which does not exist in the male of *A. massirius* and the presence of which is variable in the female);
- the decorations of the abdomen and forceps are different for the two species;
- *A. massirius* is smaller (5.5-6.0 mm) than *A. ornatus* (7-8 mm).

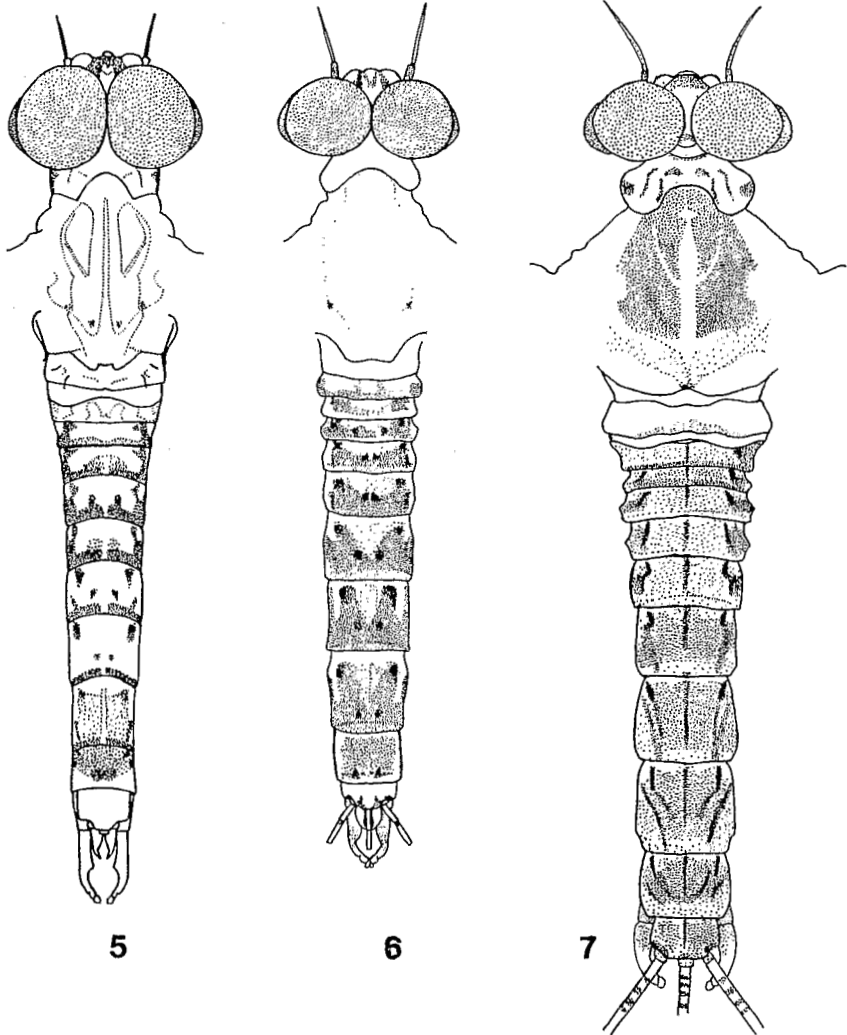
*Distribution of Adenophlebiodes massirius.*

*A. massirius* is the most abundant and ubiquitous of the five *Adenophlebiodes* s.s. species collected. In West Africa it is present from Senegal to Togo (Fig. 1) in seventeen basins (from West to East: Gambia, Rio Corubal, Fatala, Konkoure, Kolente, Little Scarcies, Seli, Pampana, Saint Paul (= Diani), Cavally, Senegal, Niger, Sassandra, Bandama, Volta, Sio and Mono). It is found in savanna as well as in forest areas, on plains and at medium altitudes. Its larvae therefore withstand a wide range of temperature and acidity and generally seem not to be very much affected by the changes in the physico-chemical qualities of the water. This species was present throughout the period of monitoring of the stations visited regularly (Sassambaya on the Niandan and Boussole on the Milo, in Guinea) i.e. at low water (flood-subsidence and low-water periods).

Specimens studied: types: 1 ♂ holotype imago (i.) and 8 ♂ paratypes caught on a tributary of the Cavally R., near Grabo, Tiboto-Grabo road (Guinea), 11.II.88; 1 ♀ paratype imago at Tai (Côte d' Ivoire), 10.II.88; 1 ♀ paratype imago at Bouafle on the Marahoue R (Côte d' Ivoire), 14.II.88; N' Zebela on the Diani R. (Guinea) 1 ♀, 4 ♂ paratypes subimagines (s.i.), 31.I.88. Types in National Museum of Natural History (MNHN), Paris.

Others: Gambia Basin: Gambia R. at Samekouta (Senegal), 2 ♂ s.i., 24.I.89; Semini R. near Termesse (Guinea), 2 ♀ s.i., 27.I.89. Rio Corubal (= Tomine) Basin: Tomine R. at Telimele (Guinea), 1 ♀ i., 27.I.87; Koumba R. at Sita (Guinea), 2 ♀ s.i., 26.I.87; at Gaoual (Guinea), 3 ♀, 3 ♂ s.i., 29.I.89; Kogon R., Boko-Gaoual road (Guinea) near Webdou-Borou, 1 ♂, 3 ♀ i., 19 ♂, 8 ♀ s.i., 30.I.89. Fatala Basin: Fatala R. near Mahbe (Guinea), 7 ♀ s.i., 1 ♂ i., 1.II.89. Konkoure Basin: Konkoure R. at Linsan (Guinea), 1 ♂ s.i., 1 ♀ i., 29.I.87; Badi R. at Samou Ade Falls (Guinea), 11 ♀, 13 ♂ s.i., 18.II.89. Kolente Basin: Kolente R. at Kora (Guinea), 1 ♀ i., 10.II.86; at Simbareya (Guinea), 9 ♂, 4 ♀ i., 28 ♀, 36 ♂ s.i., 3.II.89. Little Scarcies Basin (= Kaba): Kaba R. (Guinea), Faranah-Mamou road 7 ♀, 5 ♂ s.i., 7.II.86; 2 ♂ s.i., 1 ♀, 1 ♂ i., 23.I.87; at Utamba Kilims National Park (Sierra Leone), 3 ♀, 1 ♂ i., 3 ♀ s.i., 4.II.89; at Mange (Sierra Leone), 2 ♂ i., 6.II.89. Pampana Basin: Pampana R. near Magburaka (Sierra Leone) 1 ♀ i., 5.II.89. Seli (= Rockel) Basin: Seli R. at Bumbuna (Sierra Leone), 1 ♀ i., 10.II.89; at Badala (Sierra Leone), 2 ♀, 2 ♂ s.i., 11.II.89; at Yrafilaia (Sierra Leone), 6 ♀, 6 ♂ s.i., 12.II.89. Saint Paul (= Diani) Basin: Diani R. at N' Zebela (Guinea), 1 ♀, 2 ♂ s.i., 1 ♀ i., 31.I.88. Cavally Basin: Cavally R. at Grie (Toulepleu area, Côte d' Ivoire), 1 ♂ s.i., 4.II.88; 1 ♀ i., 1.II.88; at Oueyakole (Mount Nimba in Guinea), 1 ♀, 8 ♂ s.i., 22.I.88; tributary on the Grabo-Tiboto road, near Grabo (Côte d' Ivoire), 4 ♂ s.i., 2 ♂ i., 11.II.88. Senegal Basin: Bafing R. at Timbo (Mali), 3 ♀, 2 ♂ s.i., 31.I.87; Bakoye R. at Kokofata (Mali), 2 ♀, 1 ♂ s.i., 20.XI.84; 3 ♂ s.i., 16.X.85; 2 ♀ s.i., 12.X.86, 23.X.86; 1 ♂ s.i., 12.I.87. Niger Basin: Niandan R. at Sassambaya (Guinea), 1 ♂ s.i., 2.III.85; 10 ♀, 1 ♂ s.i., 26.III.85; 5 ♀, 1 ♂ s.i., 27.III.85; 1 ♀ s.i., 29.V.85; 2 ♀, 1 ♂ s.i., 12.II.86; 7 ♀, 3 ♂, 13.II.86; 83 ♀, 75 ♂ s.i., 21.III.86; 18 ♀, 18 ♂ s.i., 19.IV.86; 15 ♀, 9 ♂ s.i., 20.IV.86; 1 ♂ s.i., 17.VI.86; 2 ♂ s.i., 9.XII.86; 1 ♂ s.i., 20.I.87; 4 ♀, 2 ♂ s.i., 6.V.87; 3 ♂ s.i., 25.XI.87; 3 ♀ s.i., 26.XI.87; 3 ♂ s.i., 6.III.88; Loulou R. at Kissidougou (Guinea), 3 ♀, 4 ♂ s.i., 22.I.87; Woyowayanko (also called Yoyanko, tributary of the Niger) near Bamako (Mali), 1 ♀, 2 ♂ s.i., 25.IX.85; Niger R. at Bamako (Mali), 2 ♀ s.i., 24.IX.84; 10 ♀, 13 ♂ s.i., 8.X.86; at Tienfala (Mali), 46 ♀, 30 ♂ s.i., 6 ♀, 6 ♂ i., 2.II.85; 1 ♀, 1 ♀ s.i., 26.II.85; 26 ♂, 1 ♀ s.i., 11 ♀, 3 ♂ i., 20.III.85; 21 ♀ s.i., 21.III.85; 18 ♀, 1 ♂ s.i., 26.VI.85; 10 ♀, 2 ♂ s.i., 26.V.86; 12 ♀, 17 ♀ s.i., 1 ♂ i., 27.V.86; at Kouroussa (Guinea), 2 ♀, 5 ♂ s.i., 27.I.85; 1 ♀, 2 ♂ s.i., 18.VI.87; Sankarina R. at Tiro (Guinea), 1 ♀ s.i., 20.II.80; at Mandiana (Guinea), 4 ♀, 2 ♂ s.i., 7.V.85; Milo R. at Boussole (Guinea), 6 ♀, 1 ♂ s.i., 23.X.84; 2 ♀, 2 ♂ s.i., 24.I.85; 8 ♂ s.i., 17-18.II.85; 1 ♀ i., 2.III.85; 31 ♀, 68 ♂ s.i., 28.III.85; 24 ♀, 2 ♀ s.i., 26.IV.85; 1 ♂ s.i., 31.V.85; 23 ♀, 113 ♂ s.i., 22.III.86; 104 ♀, 30 ♂ s.i., 20.IV.86; 26 ♀, 8 ♂ s.i., 21.IV.86; 4 ♀, 3 ♂ s.i., 15.VI.86; 11 ♀, 2 ♂ s.i., 18.VI.86; 2 ♀, 1 ♂ s.i., 19.VI.86; at dawn, 1 ♂ s.i., 10.XII.86; 1 ♀, 1 ♂ i., 22.I.87; 8 ♀, 5 ♂, 7.V.87; at Kankan (Guinea), 1 ♀ s.i., 26.X.84; Tributary of the Milo R. at Konsankoro (Guinea), 1 ♂ s.i., 21.X.84; Bagoé R. Sikasso-Bougouni road (Mali), 1 ♀ s.i., 17.II.88. Sassandra Basin: Sassandra R. at Zozola bridge (Soubre area, Côte d' Ivoire), 1 ♀ s.i., 22.V.84; at Linguekoro (Côte d' Ivoire), 1 ♂, 1 ♀ i., 14.VIII.84; Feredougouba R. at Badala (Guinea), 1 ♂ i., 4.III.85; at Touba (Côte d' Ivoire), 1 ♀ i., 26.VIII.84;

Tributary of the N' Goli R. (Tetini Massif, Beyla area in Guinea, alt. 700 m, water temperature 23° C), 2 ♂ s.i., 2 ♂, 1 ♀ i., 9.III.88. Bandama Basin: Marahoue R. at Danangoro (Côte d' Ivoire), s.i.; at Bouafle (Côte d' Ivoire), 27 ♂, 20 ♀ s.i., 24.X.76; 1 ♀ i., 31.I.77; Volta Basin: Pru R. at Asubende (Ghana), 1 ♂, 2 ♀ s.i., 26.XI.85; Wawa R., at Dodi-Papase (Ghana), 2 ♀, 2 ♂ s.i., 21.XI.85. Sio Basin: Sio R. at Kati (Togo), 1 ♀, 2 ♂ s.i., 24.XI.85. Mono Basin: in Togo Mono R. at Atchinedji, 1 ♀ s.i., XI.85; at Kpessi, 1 ♂ s.i., 30.XI.85; 18 ♂, 2 ♀ s.i., 26.VI.85; at Landa, 11 ♀ s.i., 1.XII.85; at Tchamba, 2 ♀ s.i., 2.XI.85; at Ngambeto, 2 ♂ s.i., 29.XI.85; at Tetetou, 2 ♂ s.i., 25.XI.85. Amoutchou R. (Togo), Atakpame-Kpaline road 16 ♂ s.i., 28.XI.85.



Figs. 5 - 7. Male imagines of *Adenophlebiodes* spp., habitus in dorsal view: 5, *A. adrieni*; 6, *A. rubeus*; 7, Male subimago of *A. callasae*.



***Adenophlebiodes (Adenophlebiodes) adrieni* sp. n.**

*Adenophlebiodes adrieni* is distinguished from the other *Adenophlebiodes* s.s. known so far by the presence of markings on the apical half of the fore wing in addition to that of the basal half. This observation extends Demoulin's definition (1955) of the subgenus *Adenophlebiodes* s.s. which limits the decoration of the wing to its basal half. This species is only known by the imagines.

*Male imago* (Fig. 5). The head and the antennae (base and flagellum) are whitish. The dorsal eyes are orange-coloured and largely united at the epicranial suture. The ventral eyes are brownish-grey. The lateral and median ocelli are outlined in brown.

Thorax whitish. The fore wings (Fig. 26) are hyaline and on the basal half more or less extensive reddish-brown spots border some of the crossveins. This part of the wing resembles the corresponding part of the fore wing of *A. massirius*. On the other hand, the apical part of the wing of *A. adrieni* has a central reddish-brown spot on the radial area and a slight pigmentation around a few crossveins. The basal half of the hind wing shows a pigmentation limited to a few crossveins (Fig. 27). The apex of the wing is reddish-brown. *A. adrieni* as well as *A. massirius* differs from all other described species of the *A. ornatus* group in that the hind wing has fewer crossveins. The legs are white with brown spots (proximal and median) on the femur and the tibia (median and distal), the claws of the tarsi are identical.

Abdomen: the first five tergites have dark spots laterally. Segments VI and VII are markedly less decorated. Tergites VIII and IX show a large light, sometimes pinkish, brown dorsal area (segment IX). Ventrally, the abdomen is white. The penes and forceps are whitish (Fig. 16). The cerci and the terminal filament are missing on our specimens.

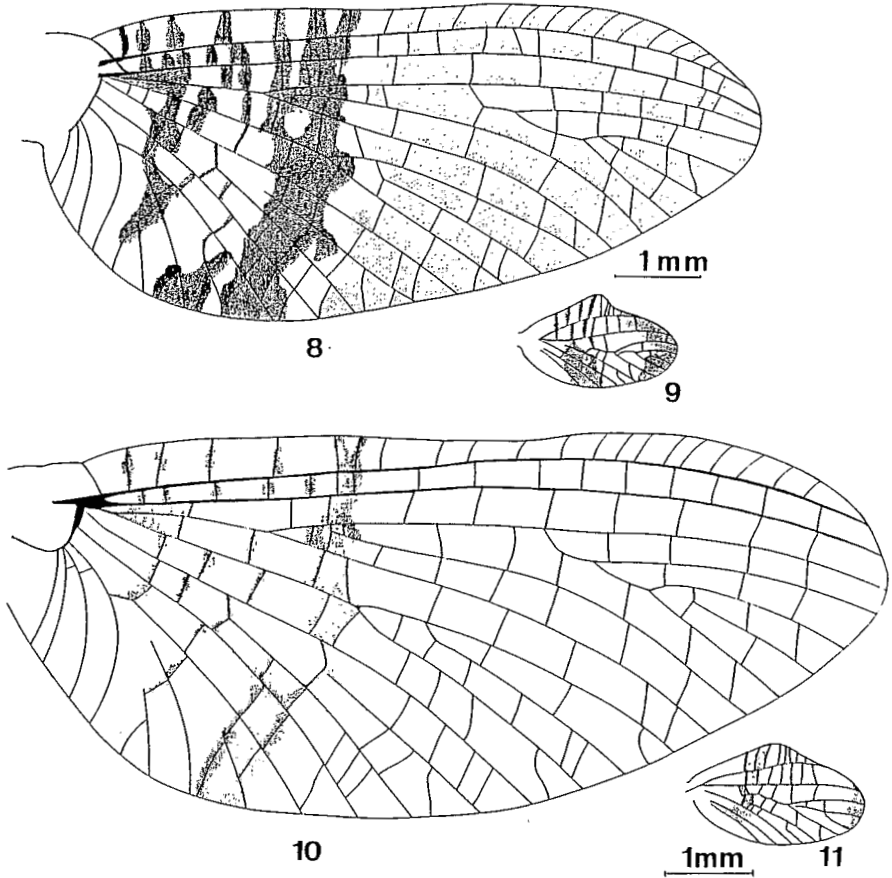
The length of the body and the fore wings is 6.5 mm.

*Female imago*. The ornamentation of the body of the female of *A. adrieni* is identical to that of the male. On the other hand, a greater number of crossveins are outlined in brown between the costa and subcosta of the fore wings (Fig. 28). The terminal filament is white with light brown rings. The subanal plate is not divided. The female has the same size as the male.

***Geographical distribution***

The specimens were caught in Guinea and Sierra Leone around Fouta Djallon, only on the banks of small rivers and at low moderate altitude (200-500 m) in wooded savanna (Fig. 17).

*Specimens studied* holotype 1 ♂ i. at the bridge across the Bafing R. (Senegal Basin), on Timbo-Dabola road on 31/1/87, paratypes 1 ♀ i. on the Konkure R. at Linsan on 29/1/1987. Gambia Basin: tributary of the Semini R. near Termesse (Guinea) 5 ♂ i. on 27/1/1989. Rio Corubal Basin: Tomine R. at Karmafassa (Guinea) 2 ♂ i. on 31/1/1989. Pampana Basin: Pampana R. near Magburaka (Sierra Leone) 2 ♀ i. on 5/2/89. Types in MNHN.



Figs. 8 - 11. *Adenophlebiodes ornatus*, male. Subimago: 8, fore wing; 9, hind wing. Imago: 10, fore wing; 11, hind wing.

## 2. *A. DECORATUS* GROUP

### *Adenophlebiodes (Adenophlebiodes) decoratus* (Navás, 1931)

*Adenophlebia decorata* Navás, 1931a, Rev. Zool. Bot. Afr., (Série V), 20 : 273.

*Adenophlebia decora* Navás, 1931b, Rev. Zool. Bot. Afr., (Série VI), 21 : 137.

*Adenophlebiodes (A) decorata*, Demoulin, 1955, Bull. Ann. Soc. Ent. Belg. 91 : 285.

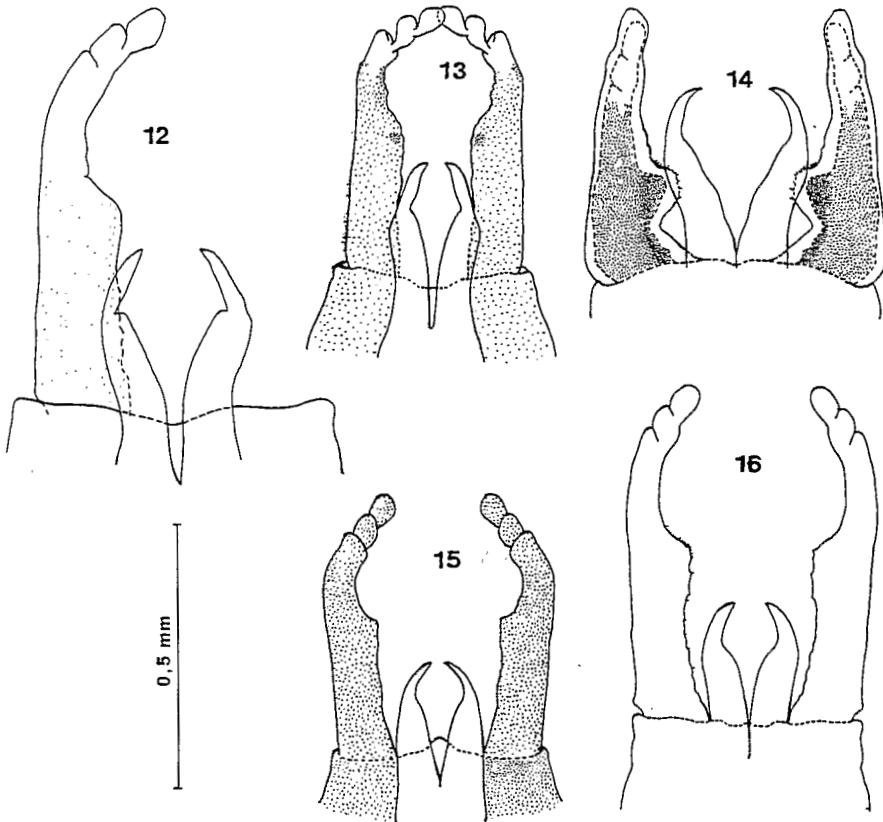
Female of *A. decoratus* differs from other species by the subanal plate divided apically (Demoulin, 1955). *A. decoratus* was recorded from Zaire by Navás (1931b), Demoulin (1955), Marlier (1958) and from Zambia by Gillies (1963). Not found in sites explored by ORSTOM hydrobiologists, its area of distribution seems restricted to Central and East Africa.

**Adenophlebiodes (Adenophlebiodes) bicolor** (Crass, 1947)

*Euphlebica bicolor* Crass, 1947, Ann. Natal Mus., 11 :104.

*Adenophlebiodes bicolor*, Edmunds, 1953, Rev. Zool. Bot. Afr., 48 (1-2): 79.

Described from Natal, South Africa, (in *Euphlebica*) (Crass, 1947). The single record from West Africa is that of *Habrophlebica delamarei* (partim, ♀) Verrier (1951) from Côte d'Ivoire which was suspected by Kimmins (1960) to be *A. bicolor* apparently on the very brief description of the wings. Since recent surveys of West Africa and especially of Côte d'Ivoire by ORSTROM teams have failed to reveal the presence of the South African species, it is concluded that the presence of *A. bicolor* in West Africa now therefore seems unlikely.



Figs. 12 - 16. Genitalia of *Adenophlebiodes* spp. males, imagines (12, 13, 15, 16) and subimagines (14): 12, *A. ornatus*; 13, *A. rubeus*; 14, *A. callasae*; 15, *A. massirius*; 16, *A. adrieni*.

**Adenophlebiodes (Adenophlebiodes) rubeus** sp. n.

*Male imago* (Fig. 6). Head: the background colour is whitish, the eyes, which are brown, touch each other but not as closely as for *A. adrieni*. The base of the three ocelli is outlined in brown. The base of the antenna is brown, the flagellum is pale.

Thorax: the prothorax is whitish with lateral spots, the meso- and metathorax are white. The fore wings are divided into two parts: a basal half with a brownish-red membrane (but not very dark between Sc, C, and Rs-R2) whose veins are all brown and the crossveins bordered by a brownish-red colour darker than the background and a hyaline apical half (Fig. 29). The two areas are separated by a dark brownish-red band. The hind wings have an almost uniformly brownish-red background, the crossveins are brown (Fig. 30). The legs are cream-coloured with brown spots (proximal and median) on the femur and on the tibia (median and distal), the claws of the tarsi are identical.

Abdomen: the tergites are almost completely brownish-red (however, some specimens can be more brownish than reddish) with darker pairs of spots (see Fig. 6). The ventral decoration is quite similar to the dorsal decoration, especially for segments V to IX. Two-thirds of the basal part of segment one of the forceps are red (Fig. 13). The cerci and the terminal filaments are white with brown rings.

Measurements: length of the body 6 mm, of the fore wing 6.5-7.0 mm.

*Female imago*. The female is quite identical to the male, but the abdomen, on the whole, is more pale and colour less, the length of the body is 6.0-6.5 mm, with a fore wing of 5.5-6.0 mm. The subanal plate is not divided.

*Subimago*. The male and female subimagines are close to the imagines but their fore wings are divided into two zones by an opaque band: a basal half identical to that of the imago but more brown than red, and a light brown apical area with opaque crossveins at the margins. (Figs. 31, 32).

*Comparison with A. decoratus and A. bicolor*

*A. rubeus* closely resembles *A. decoratus*, the wing markings being almost identical. It differs from that species in the cream colour of the fore femora and the whitish thorax. The undivided subanal plate of the female also serves to differentiate it. It is distinguished from *A. bicolor* by greater number of crossveins in the fore wing and from *A. callase* by the markings on the subimaginal wing.

*Distribution of A. rubeus.*

*A. rubeus* has been caught in Guinea, Sierra Leona and Côte d'Ivoire, in moist savanna and forest zone (Fig. 17).

*Specimens studied*: holotype 1 ♂ imago, paratypes 24 ♂ and 4 ♀ imagines caught on a tributary of the Cavally R., near Grabo, on the Tiboto-Grabo (Guinea) road on 11/2/88. Type in MNHN.

Others: Gambia Basin: on a tributary of the Semini R. near Termesse (Guinea), 3 ♂ i. on 27/1/89). Rio Corubal Basin: on a tributary of the Tomine R., 35 km to the north of Telimele (Guinea), 19 ♂, 6 ♀ s.i., 23 ♂, 3 ♀ i. on 27/1/87, Fatala Basin: Fatala R. near Mahbe (Guinea), 7 ♂, 3 ♀ s.i. on 1/2/89. Konkoure Basin: on the Kokolo R., Pita-Madina road (Guinea), 2 ♂, 2 ♀ s.i., 25/1/85. Sewa Basin: Sewa R. near Jaiama (Sierra Leone), 1 ♂ i. on 9/2/89. Little Scarcies Basin: on the Kaba R., Faranah-Mamou road (Guinea), 1 ♂ i., on 7/2/86. Cavally Basin: Cavally R. at Queyakole (Mount Nimba in Guinea) 1 ♂ i. on 22/1/88; tributary of the Cavally R., to the north-west of Mt. Nimba, 2 ♂, 1 ♀ s.i. on 1/2/88. Saint Paul (= Diani) Basin : Diani R. at N'Zebela (Guinea) 3 ♂ i. on 31/1/88. Senegal Basin: on the Tene R., near Dalaba 6 ♀, 4 ♂ s.i. on 24/1/87. Niger Basin : Milo R. at Boussoule (Guinea) 1 ♂ s.i., 1 ♀ i. on 22/1/87; Tinkisso R. at Dabola (Guinea) 1 ♂ s.i. on 1/2/87; Upper Niger R. near the sources (Guinea) 1 ♀ i. on 6/2/85; Tributary of the Niger R. at Kissidougou (Guinea) 2 ♂ s.i. on 22/1/87. Sassandra Basin: Feredougouba R. at Badala (Guinea) 1 ♂ i. on 4/2/85, at Touba (Côte d'Ivoire) on 26/4/84). Tributary of the N'Goli R. (Guinea) 3 ♂ i. on 9/2/88. Also examined : 2 ♀ i. Banco (Côte d'Ivoire), on 11/8/45 (Verrier's collection).

### *Adenophlebiodes callasae* sp. n.

This species is known only by its male and female subimagines.

*Male subimago.* (Fig. 7). Head: the dorsal eyes are orange-coloured and do not touch. The space between them is a bit less than half the width of one lateral ocellus. The ventral eyes are dark grey in colour. The lateral and median ocelli are bordered in brown. The base of the ocelli is brown, the flagellum is slightly more pale.

Thorax: the background colour of the prothorax is quite light brownish-grey with dark blackish-grey spots, the mesothorax is brown, the metathorax is pale.

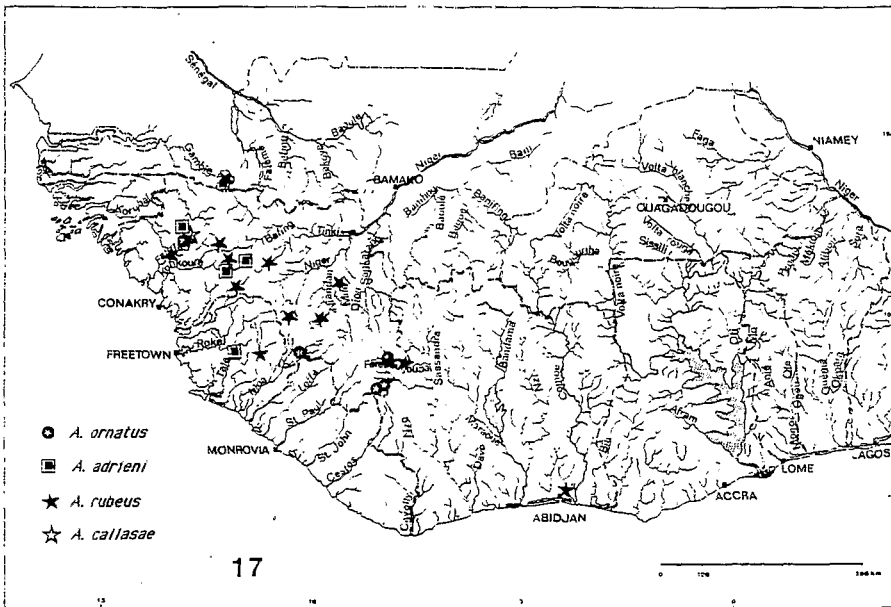
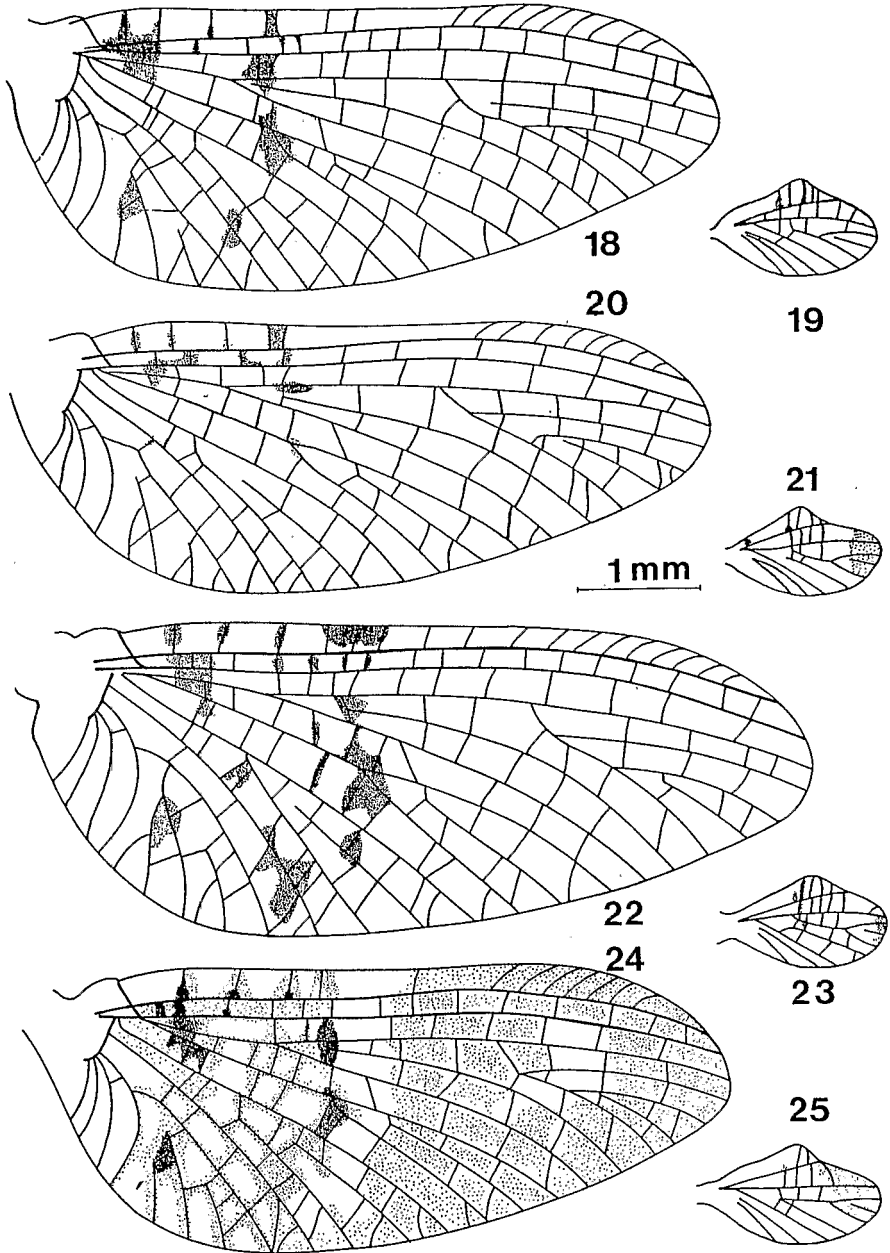
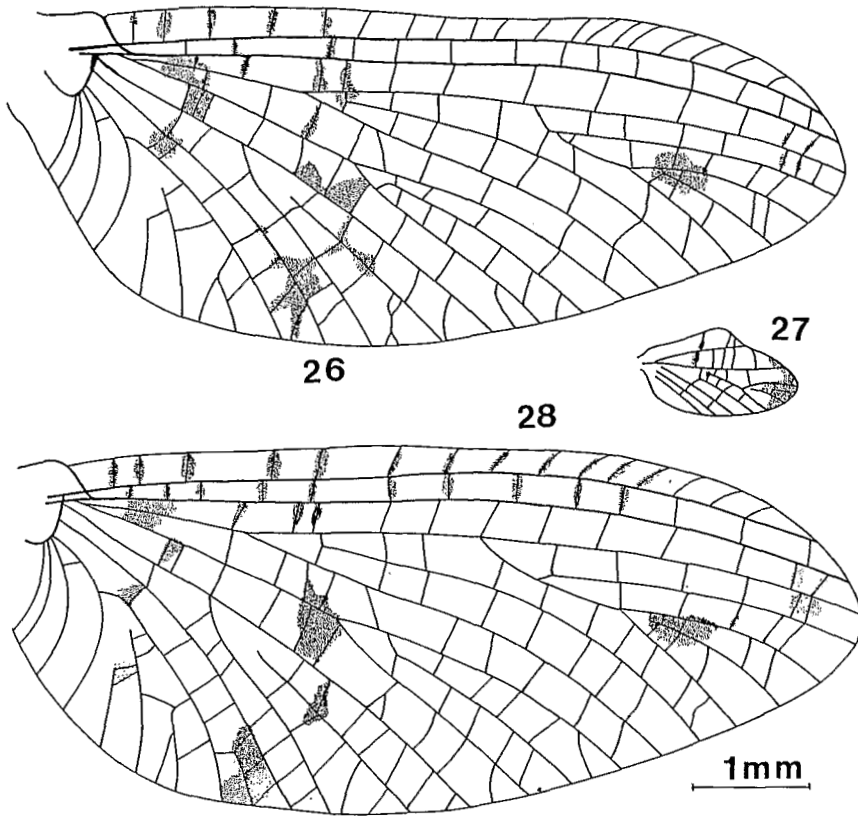


Fig. 17. Distribution of *A. ornatus*, *A. adrieni*, *A. rubeus* and *A. callasae* in West Africa.



Figs. 18 - 25. *Adenophlebiodes massirius*: male imago (18-21), female imago (22, 23) and male subimago (24, 25) : 18, 20, 22, 24, fore wings; 19, 21, 23, 25, hind wings.



Figs. 26 - 28. *Adenophlebiodes adrieni*, male fore (26) and hind (27) wings, female fore wing (28).

The basal half of the fore wing is dark brown, the crossveins are much darker. A band from the fore margin to the posterior margin of the wing, coloured just as the crossveins, separates the basal area from the apical area; the latter is of a uniform grey colour (Fig. 33). The hind wings are completely grey, some crossveins are more deeply pigmented (Fig. 34). The legs are light brown with maculations at the same places as the preceding species: a median and distal spot on the femur, a proximal and median spots on the tibia. The tarsus has five segments, the claws are identical.

Abdomen: the overall impression from a dorsal view is that of a quite dark abdomen with an almost black long median spot and lateral spots of the same colour on each segment. Segments VI, VII, VIII, IX are darker than the previous ones, especially segments IV and V. From a ventral view, the sternites have a greyish-yellow colour, the last four being the darkest, the last three having two small lateral spots. The forceps are brown on half of segment one and pale at

their margin. The penes are pale (Fig. 14). The cerci and the terminal filaments are annulated in brown.

The measurements are as follows: 7 mm for the body and the wings.

*Female subimago.* The female is identical to the male; the subanal plate is not divided. It is a bit bigger than the male (7.5 mm), its wings are of the same length as the body.

*Comparison with the subimagines of A. decoratus, A. bicolor, and A. rubeus.*

The subimago of *A. callasae* differs from both *A. decoratus* and of *A. rubeus* in the absence of an opaque band separating the basal half from the apical half of the wing. It is distinguished from *A. bicolor* by the greater number of crossveins.

*Specimens studied:* *Adenophlebiodes callasae* was caught in Guinea (Fig. 17) on a tributary of the Tomine R. (Rio Corubal Basin) 35 km to the north of Telimele, on 27/1/87 (3 ♂ and 4 ♀ subimagines), therefore in forest zone (thick gallery forest). Type 1 ♂ s.i., paratype 1 ♀ s.i. in MNHN.

#### Key to the imagines of the West African *Adenophlebiodes* s.s.

- 1a - Membrane of basal half of fore wing hyaline with spots more or less spread out and linked to the others ..... 2
- 1b - Membrane of basal half of fore wing coloured ..... 5
- 2a - Presence of spot on apical portion of fore wing ..... *A. adrieni*
- 2b - Absence of spot on fore wing ..... 3
- 3a - Pigmented continuous band separating basal half from apical half of the fore wing. Colour of fore femora variable ..... 4
- 3b - Absence of continuous pigmented band separating basal half from apical half; the fore femur is brown ..... *A. massirius*
- 4a - Fore femur white, the size of the body 7 mm ..... *A. ornatus*
- 4b - The fore femur brown, the size of the body 5.5-6.0 mm ..... *A. massirius*
- 5a - The number of crossveins of the pterostigmatic area is close to 10. Fore femur is white. The subanal plate of the ♀ is not divided ..... 6
- 5b - The number of crossveins of the pterostigmatic area is close to 16; the fore femur of the ♀ is reddish-brown, the subanal plate is divided ..... *A. decoratus*
- 6a - Crossveins scanty, in the unpigmented area between MA1 and the point where CuA1 reaches the wing margin there are about 4 crossveins; mesothorax dark ..... *A. bicolor*
- 6b - Crossveins numerous, in the area between MA1 and CUA1 there are about 20 crossveins; mesothorax pale ..... *A. rubeus*

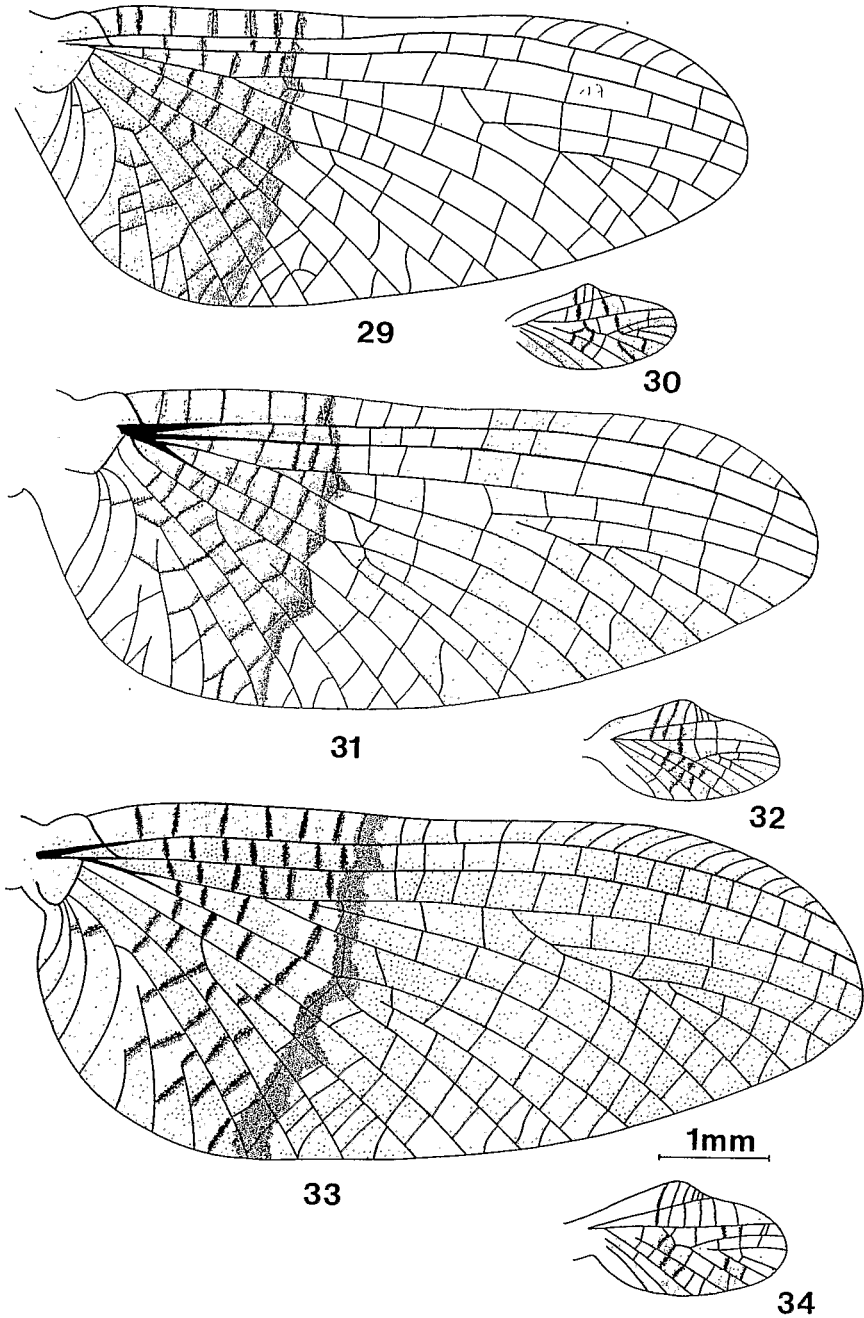
#### ACKNOWLEDGEMENT

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#### RESUME

Le sous-genre *Adenophlebiodes* comprend en Afrique de l'Ouest cinq espèces réparties en deux groupes: le groupe *A. ornatus* qui comporte *A. (A.) ornatus* (Ulmer), *A. (A.) massirius* sp. n. et *A. (A.) adrieni* sp. n. et le groupe *A. decoratus* (Navás) comprenant *A. rubeus* sp. n. et *A. callasae* sp. n. L'une de ces espèces, *A. massirius* est largement distribuée de la Guinée au Togo et se trouve aussi bien en plaine qu'en moyenne altitude, en savanne qu'en zone forestière; les autres espèces ont une distribution





Figs. 29 - 34. *Adenophlebiodes rubeus* (29 - 32), male imago: 29, fore wing; 30, hind wing; male subimago: 31, fore wing; 32, hind wing. *Adenophlebiodes callasae* (33, 34) : male subimago : 33, fore wing; 34, hind wing.

plus restreinte. Sur l'aire d'étude, *A. decoratus*, espèce décrite d'Afrique centrale n'a pas été retrouvée. Il en va de même pour *A. bicolor* (Crass) dont la présence en Afrique de l'Ouest devient donc discutable. Cette dernière espèce est apparentée au groupe *decoratus*. L'examen des spécimens ainsi que les descriptions existantes permettent d'établir une clé de détermination.

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