

## *Ephemeroptera from West Africa : The genus Pseudopannota (Baetidae)*

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### SUMMARY

*Descriptions are given of the adults of the genus Pseudopannota, previously only known from the nymphs. A new species, Pseudopannota (Pseudopannota) muganinani, is described from West African rivers. A new subgenus, Hemipannota, is recognized, incorporating the South African species, Pseudopannota maculosa Crass, formerly placed in Pseudocloeon, and a new species from West Africa, P. (H.) modesta. Distribution maps of the West African species are given, together with notes on ecology.*

KEY WORDS : Ephemeroptera — Baetidae — *Pseudopannota* — Geographical distribution — Ecology — Taxonomy — West Africa.

### RÉSUMÉ

#### ÉPHÉMÈRES D'AFRIQUE DE L'OUEST. LE GENRE *PSEUDOPANNOTA* (BAETIDAE)

*Les auteurs décrivent les adultes du genre Pseudopannota dont seules les formes larvaires étaient connues jusqu'alors. Une nouvelle espèce, Pseudopannota (Pseudopannota) muganinani, est décrite des rivières d'Afrique de l'Ouest. Un nouveau sous-genre, Hemipannota, est créé. Il comprend l'espèce sud-africaine Pseudopannota maculosa Crass, classée à ce jour dans le genre Pseudocloeon et une nouvelle espèce d'Afrique de l'Ouest P. (H.) modesta. Pour chaque espèce, une carte de la distribution connue en Afrique de l'Ouest est donnée et lorsque cela est possible, des éléments d'écologie.*

MOTS-CLÉS : Éphéméroptères — Baetidae — *Pseudopannota* — Distribution géographique — Écologie — Systématique — Afrique de l'Ouest.

### INTRODUCTION

During a visit to the Côte d'Ivoire in 1957, the veteran freshwater biologist, Prof. H. BERTRAND, collected a curious Baetid nymph, later described by

DEMOULIN (1967) as *Pseudocloeon bertrandi*. When the problem of the polyphyletic genus *Pseudocloeon* Klapálek was finally attacked, one of the first actions of WALTZ and McCafferty (1987) was to remove *P. bertrandi* from *Pseudocloeon* and create

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the new genus *Pseudopannota* for it. A second species from Madagascar, *P. vinckei*, was also included.

We have recently been able to rear the adults of *P. bertrandi* from nymphs collected in Guinea and Côte d'Ivoire. We have also reared another species *P. muganinani* related to *P. bertrandi*, from some of the same rivers, and have collected the nymphs of a third West African species of the genus (*P. modesta*). This last differs markedly from typical *Pseudopannota* in that the wing buds of the nymph are only fused at the extreme base. On the other hand, it is closely related to the South African species, *Pseudocloeon maculosum* Crass. The subgenus, *Hemipannota*, is created to accommodate these two.

The genus is redefined as follows :

### *Pseudopannota* Waltz and McCafferty, 1987

#### ADULT

Fore wings with paired marginal intercalaries; hind wings absent. Male forceps with 3 segments, basal segment poorly defined, width of terminal segment at base not much less than apex of 2nd segment.

#### NYMPH

Labrum with a single lobe, notched medially on anterior margin; mandibles with fused canines, bases of prosthecae appearing recessed into mandibular margin; ridge between caninae and molar region of right mandible with an angle projection at outer end and with or without a few short, stout setae. Maxillary palps exceptionally long, with three segments, the third segment the longest and extending well beyond galea-lacinia. Glossae and paraglossae of labium subtruncate apically, subparallel and with long fine setae apically, paraglossae slightly longer than glossae; palps with 2 segments, the second rounded and broader, sometimes much broader than the basal one.

Wing pads fused in mid line, at least at bases, obscuring tip of mesoscutellum (fig. 1). Femora

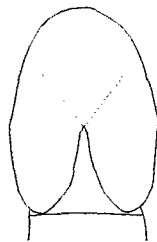


FIG. 1. — *Pseudopannota* sp., mesonotum.  
Mésionotum de *Pseudopannota* sp.

without a ventral setal patch; tarsal claws strongly formed, with a single row of stout teeth.

Abdominal terga with scales and fine setae. Gills ovate, rounded, thickened along anterior margin, with distinctly spiculate surface and serrated margins. Terminal filament subequal or shorter than cerci.

We are recognizing two subgenera *Pseudopannota* s.s. and *Hemipannota*.

#### Subgenus *Pseudopannota* Waltz and McCafferty

Nymph of the crawling type, squat. Wing pads fused for at least two thirds of their length, forming with the mesonotum a shield appearing curved in lateral view, covering at least the first abdominal segment.

Type species *Pseudopannota* (*P.*) *bertrandi* (Demoulin, 1967).

Included species :

*P.* (*P.*) *vinckei* (Demoulin, 1973).

*P.* (*P.*) *muganinani* sp. n.

Subgenus *Hemipannota* subgen. n. Elouard and Gillies

Nymphs of the swimming type, wing pads fused at extreme bases only.

Type species *Pseudopannota maculosa* (Crass, 1947).

Included species :

*P.* (*H.*) *modesta* sp. n.

### DESCRIPTION OF THE SPECIES

The overall distribution of collecting sites in West Africa is shown in fig. 2. In the listing of distributions the following abbreviations are used for the different countries : Burkina Faso = B. F., Côte d'Ivoire = C. I., Gambia = Gb., Ghana = Gh., Guinea = G., Mali = M., Sénégal = S., Sierra Leone = S. L., Togo = T.

#### Subgenus *Pseudopannota*

##### *Pseudopannota* (*P.*) *bertrandi* (Demoulin)

*Pseudocloeon bertrandi* DEMOULIN, 1967, *Bull. Ann. Soc. R. Entomol. Belg.*, 103 : 227.

*Pseudopannota bertrandi*, WALTZ and McCafferty, 1987. *Proc. Entomol. Soc. Wash.*, 89 (1) : 96.

Male imago. Turbinate eyes broad, yellowish-orange to pale brown, contiguous but separation variable. Antennal flagellum 1 1/2 times diameter of eye. Thorax generally pale yellow with light brown markings, prothorax largely unmarked, mesonotum

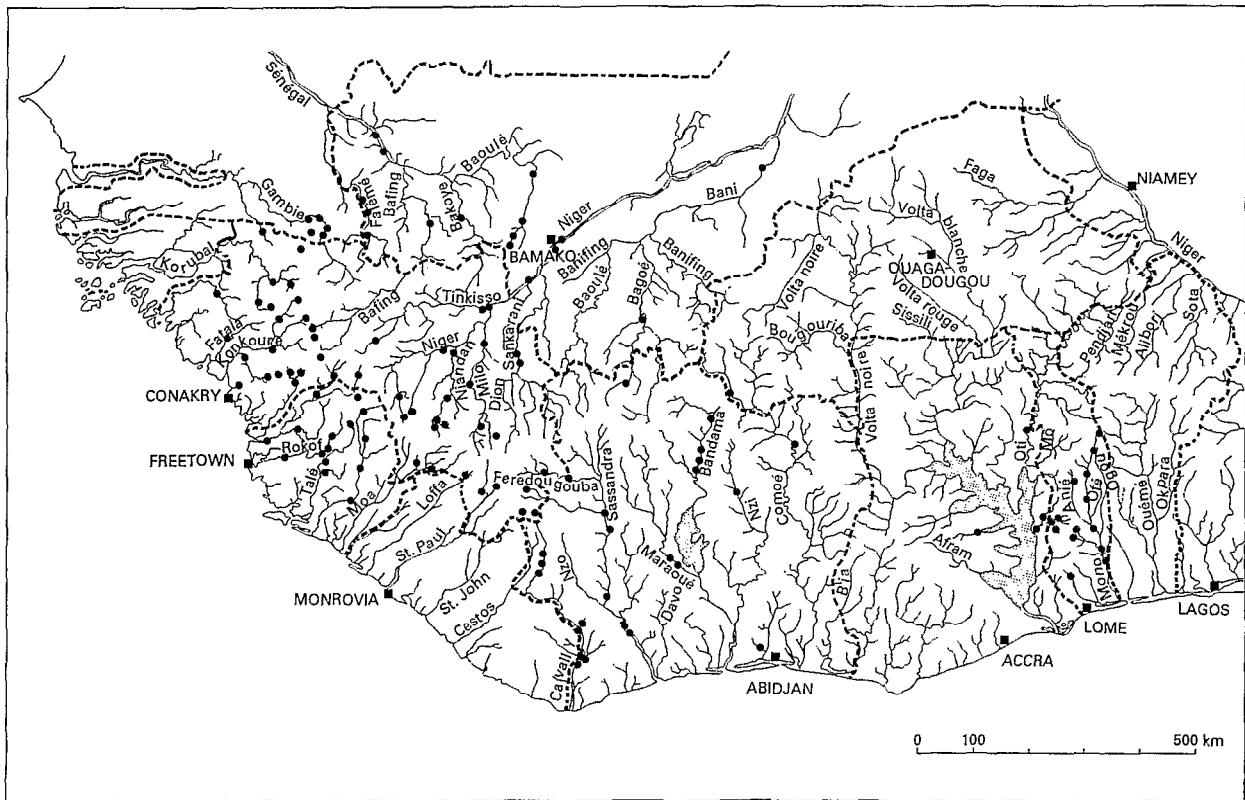


FIG. 2. — Localisation of the collecting sites.  
*Localisation des points d'échantillonnage.*

with a well-marked, median, brown longitudinal band and lateral brown bands (fig. 3). Metanotum pale anteriorly, brown posteriorly. Wings hyaline, except in costal and subcostal areas (fig. 4); two cross veins only in the subcostal area. Abdominal terga I-IV white, V-X variable due to preservation, yellowish- or occasionally reddish-brown; in the most strongly marked specimens there are median and lateral pigmented spots. Sterna I, VIII-IX brown, other sterne white with small, lateral brown spots. Forceps base lacking internal protuberance, forceps with three segments, terminal segment ovoid; IXth sternum between limbs of forceps base straight (fig. 5).

Body 5 mm. Wings: length 5.5 mm, width 2.3 mm.

Female imago. Abdominal markings as in figure 6. Lateral margins of terga II-V reddish-orange, forming a continuous band along the sides of the anterior part of the abdomen; tergum IV almost entirely coloured, less marked on VII-X.

Nymph. Well described by DEMOULIN (1967). We give here figures and brief description for comparison with other species.

Mainly characterized by the complete fusion of the wing buds along the mid line, forming a mesothoracic shield, larger in the female than in the male, and overlapping the anterior abdominal segments (fig. 7a, b).

Mouthparts: right mandible with a large tooth internal to the prostheca (fig. 8), right canine with 4 teeth; canine of left mandible with 3 teeth, the outer tooth being the largest. The axis of the distal segment of the labial palps transverse, allowing it to over lap the glossa and paraglossa completely.

Femora broad, posterior margin with stout, spine-like setae, a transverse line of preapical, spine-like setae also present. Tarsal claws strong with 2 stout denticles (fig. 8f). Gills 7, well developed, margins and upper surface with fine spines. Terminal filament subequal to cerci, with abundant marginal hairs.

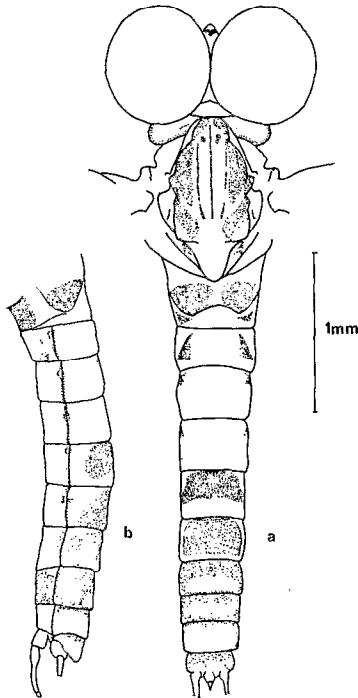


FIG. 3. — *Pseudopannota bertrandi* imago ♂. a : dorsal view, b : lateral view.  
*Pseudopannota bertrandi* imago ♂ a : vue dorsale, b : vue latérale.

Adults and nymphs were associated by rearing *in situ*.

**ECOLOGY**

Nymphal density rises as water falls at the beginning of the dry season and reaches a peak at the end of the dry season (April) at the time of the seasonal low. In rivers in which flow is seasonal the annual peak occurs at the beginning of the dry season, just before the water stops running.

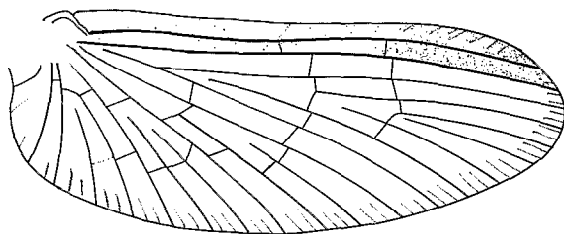


FIG. 4. — *Pseudopannota bertrandi* imago ♂, wing.  
*Pseudopannota bertrandi* imago ♂, aile.

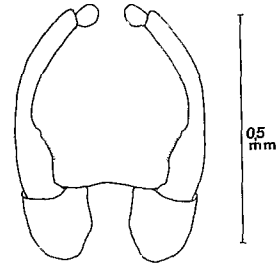


FIG. 5. — *Pseudopannota bertrandi* male genitalia.  
*Pseudopannota bertrandi* genitalia mâle.

Nymphs of *P. bertrandi* are abundant under rocks and Podostemaceae (aquatic angiosperms, resembling a layer of moss covering submerged stones). In Podostemaceae, numbers are greater where the current is moderate (about  $0.7\text{m s}^{-1}$ ) rather than under stones in places where the flow is greatest (ELOUARD, 1983). It appears, then, that although *P. bertrandi* nymphs are rheophilic, they do not live directly exposed to the current.

Studies by one of us (J. WUILLOT) on the rate of development have been carried out in rearing cages. It appears that complete development of the nymphs requires only two to three weeks, a very short period of time compared with Baetidae that have been studied in the Holarctic Region.

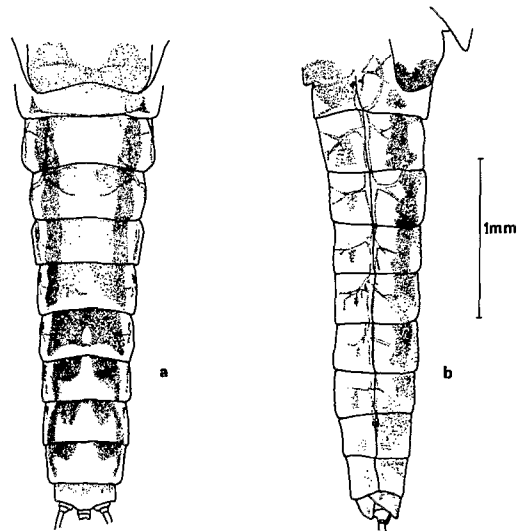


FIG. 6. — *Pseudopannota bertrandi* imago ♀. a : dorsal view, b : lateral view.  
*Pseudopannota bertrandi* imago ♀. a : vue dorsale, b : vue latérale.

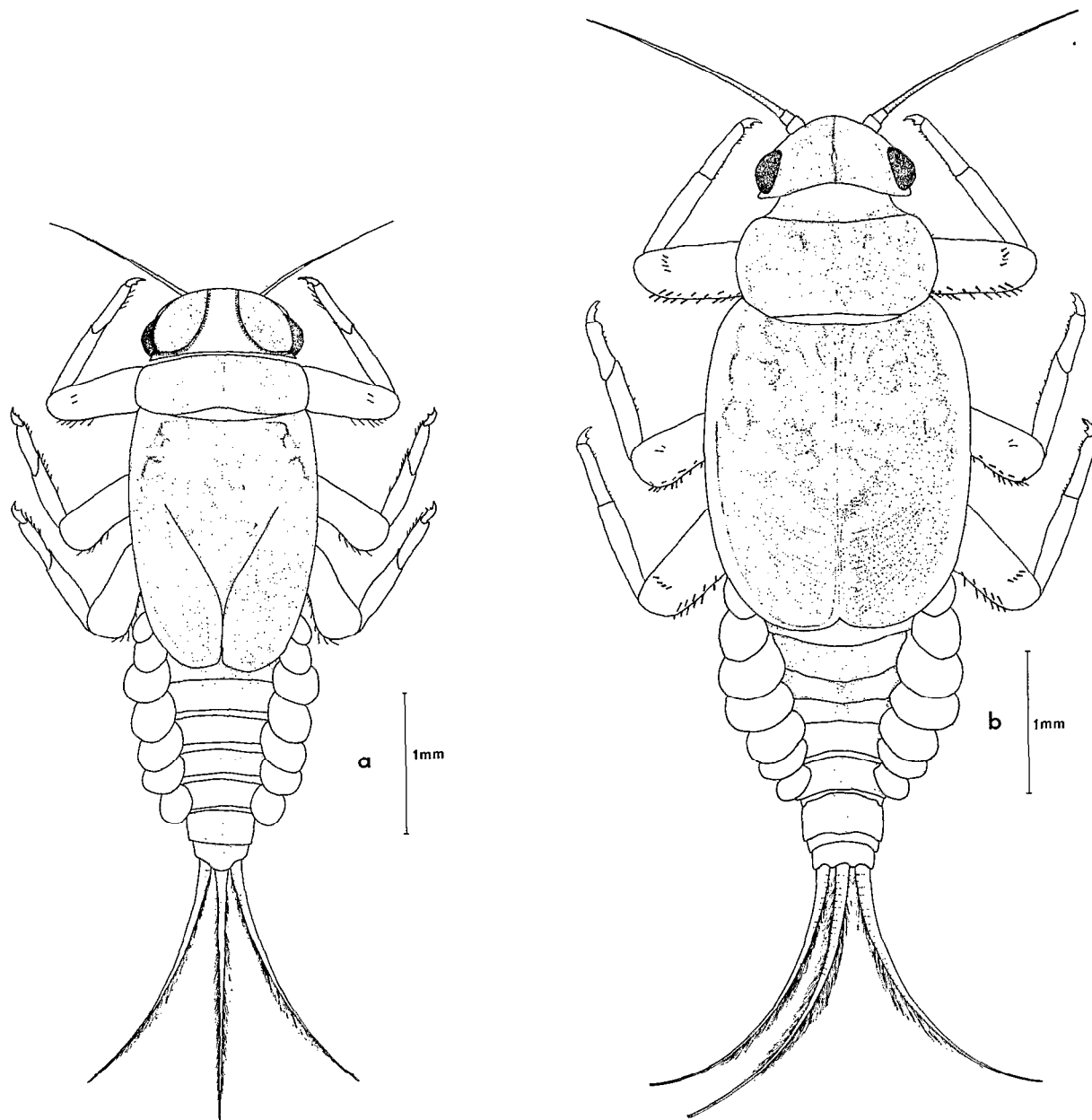


FIG. 7. — *Pseudopannota bertrandi*. a : male nymph, b : female nymph.  
*Pseudopannota bertrandi*. a : larve mâle, b : femelle.

#### GEOGRAPHICAL DISTRIBUTION

This species appears to be present in all West African rivers, with the exception of those at high altitude (fig. 9).

*Niger basin* : Milo River at Boussoule (G.) : 22/V/86, 15 NN.  
 Niger River at Bamako (M.) : 14/IX/84, 19 ♂ i. (i. = imago);

14/III/85, 1 ♂ s.i. (s.i. = subimago); Niger River at Tienfala (M.) : 2/II/85, 1 ♀ s.i.; 16/VII/85, 3 ♂ s.i., 6 ♀ s.i.; 28/V/86, 2 ♂ i. Niandan River at Sassambaya (G.) : 19/IV/86, 1 ♂ i., 22 NN.; 20/IV/86, 5 ♂ i.; 6/III/88, 5 ♂ i., 1 NN; 5/IV/88, 30 ♂ i.; 12/IV/88, 1 ♂ i., 1 ♀ i., 1 ♀ s.i.; 6/IV/88, 10 ♂ i., 19 NN. Tinkisso River at Dabola (G.) : 1/II/87, 1 ♂ i. *Senegal basin* : Senegal River at Felou falls (M.) : 13/I/86, 2 ♂ i.,

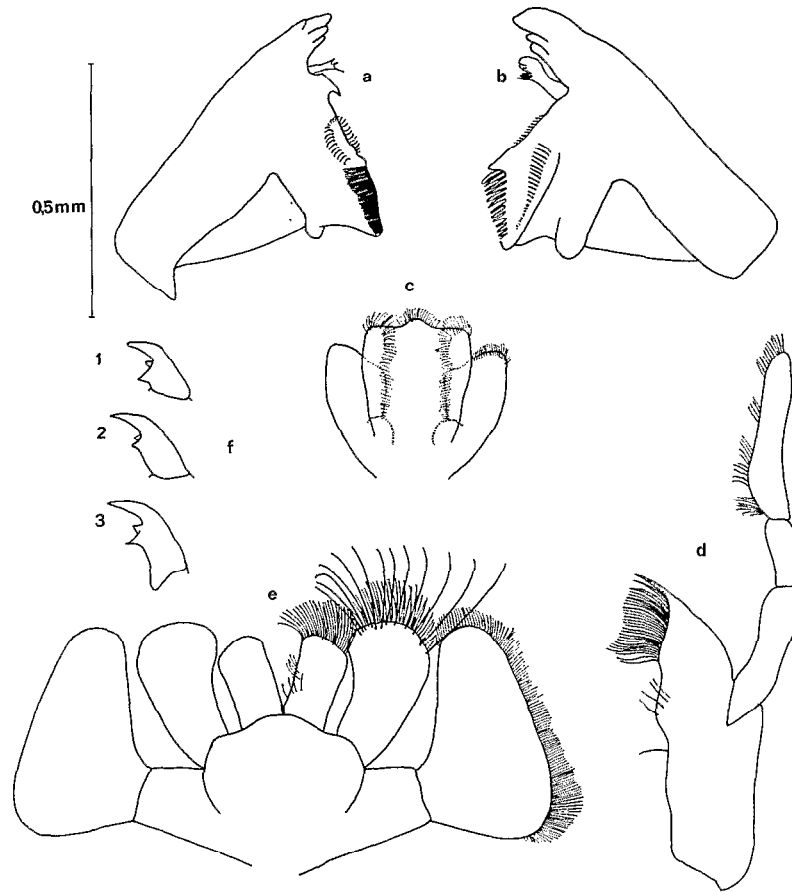


FIG. 8. — *Pseudopannota bertrandi* mouhparts of the nymph. *a* : right mandible, *b* : left mandible, *c* : hypopharynx, *d* : left maxilla, *e* : labium, *f* : claws.

*Pseudopannota bertrandi*. Pièces buccales de la larve. *a* : mandibule droite, *b* : mandibule gauche, *c* : hypopharynx, *d* : maxille gauche, *e* : labium, *f* : griffes.

2 ♀ i. Bakoye River at Kokofata (M.) : 12/XI/84, 30 NN ; 17/VII/87, 1 ♂ i. Falémé River at Djidian-Kenieba (M.) : 13/IX/84, 15 NN. Baoulé River at Missira (M.) : 14/XI/84, 3 NN. ; 22/XI/84, 16 NN. ; 15/X/86, 30 ♂ i. Bafing River at Timbo (G.) : 31/I/87, 2 ♂ s.i., 1 ♀ s.i. *Gambia basin* : Gambia River at Darenton-Bafoulade ford near Simenti (S.), 23/II/83, 5 NN. ; Gambia River at Mako (S.) 26/II/83, 1 N ; Gambia River at Bansang (Gb.), -/IX/88, 3 NN. ; *Bandama basin* : Bandama River at Niakaramandougou (C. I.) : 14/VI/76, 10 NN. Bandama River at Tiassalé (C. I.) : 11/III/78, 2 NN. ; Maraoué River at Danangoro (C. I.) : 17/VI/75, NN ; 17/XII/79, 2NN ; 19/III/76, NN ; 26/IV/76, 6 ♂ s.i., 1 ♂ i. ; Maraoué River at Yaokro (C. I.) : 22/IV/80, 11 NN. 17/III/79, 4 NN. Maraoué River at Entomokro (C. I.) : 26/IV/76, 4 ♂ s.i. ; 6/III/79, 1 NN. N'Zi River at Tinbe (C. I.) : 11/VI/76, 3 NN., 22 ♂ s.i. *Seli basin* : Seli River at Yrafilaia (S. L.) : 7/II/89, 2 ♂ i. Seli River at Badala (S. L.) : 11/II/89, 1 ♂ i. *Mono*

*basin* : Mono River at N'gabetto (T.) : 29/XI/85, 5 ♂ i. ; Mono River at Atchinedji (T.) : 26/XI/85, 51 ♂ i. ; Mono River at Kpessi (T.) : 30/XI/85, 20 ♂ i, 2 ♂ s.i. *Rio Korubal basin* : Tomine River at Karmafassa (G.) : 31/I/89, 1 ♂ i. Koumba River at Gaoual (G.) : 29/I/89, 3 ♂ i. ; Koumba River at Sita (G.) : 26/I/87, 2 ♂ i, 5 NN. *Little Scarcies basin* : Kaba River at Mange (S. L.) : 6/II/89, 1 ♂ i. ; Kaba River road Mamou-Faranah (G.) : 7/II/86, 1 ♂ i. *Cavally basin* : Cavally River at Taï (C. I.) : 10/II/88, 1 ♂ i. Cavally River at Grié (C. I.) : 4/II/88, 1 NN. N'Zé River at Taï (C. I.) : 10/II/88, 2 ♂ i., 1 ♀ s.i. *Comoé basin* : Comoé River at M'Basso (C. I.) : 12/III/78, 15 NN. Léraba Riber at the boundary bridge (C. I.) : 8/VII/75, 2 ♂ i. *St. Paul basin* : Diani River at N'Zébéla (S. L.) : 31/I/88, 1 ♂ i. Loffa River at Boola (G.) : 8/III/88, 1 ♂ i. *Fatala basin* : Fatala River at Mahbe (G.) : 1/II/89, 5 ♂ i.



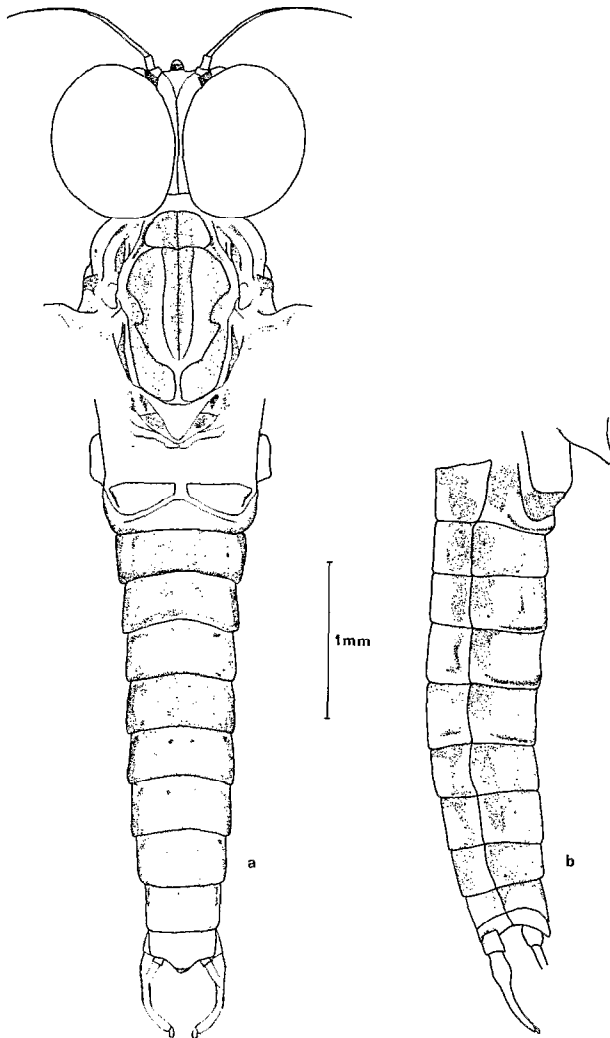


FIG. 10. — *Pseudopannota muganinani* imago ♂. a : dorsal view, b : lateral view.  
*Pseudopannota muganinani* imago ♂. a : vue dorsale, b : vue latérale.

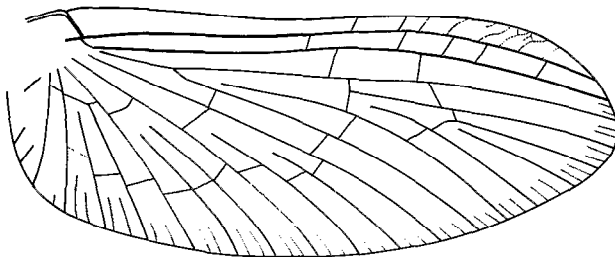


FIG. 11. — *Pseudopannota muganinani* imago ♂, wing.  
*Pseudopannota muganinani* imago ♂, aile.

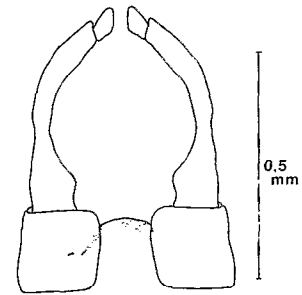


FIG. 12. — *Pseudopannota muganinani* male genitalia.  
*Pseudopannota muganinani* génitalia mâle.

forming a well developed comb (fig. 15f). Seven pairs of gills present, the first markedly smaller than the rest; gill margin sparsely clothed with spine-like hairs. Terminal filament equal to cerci, with abundant marginal hairs.

Association between nymphs and male and females was obtained by rearing.

The adult differs from *P. bertrandi* by the abdominal markings and the presence of crossveins in the subcoastal area of the wings. The nymph is distinguished by the striking black colour of the thorax and terga IX and X. The incomplete fusion of the wing buds is also distinctive.

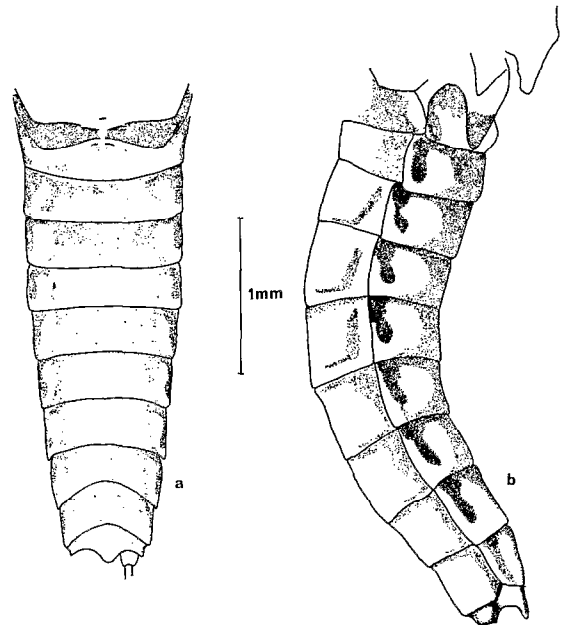


FIG. 13. — *Pseudopannota muganinani* imago ♀. a : dorsal view, b : lateral view.  
*Pseudopannota muganinani* imago ♀. a : vue dorsale, b : vue latérale.



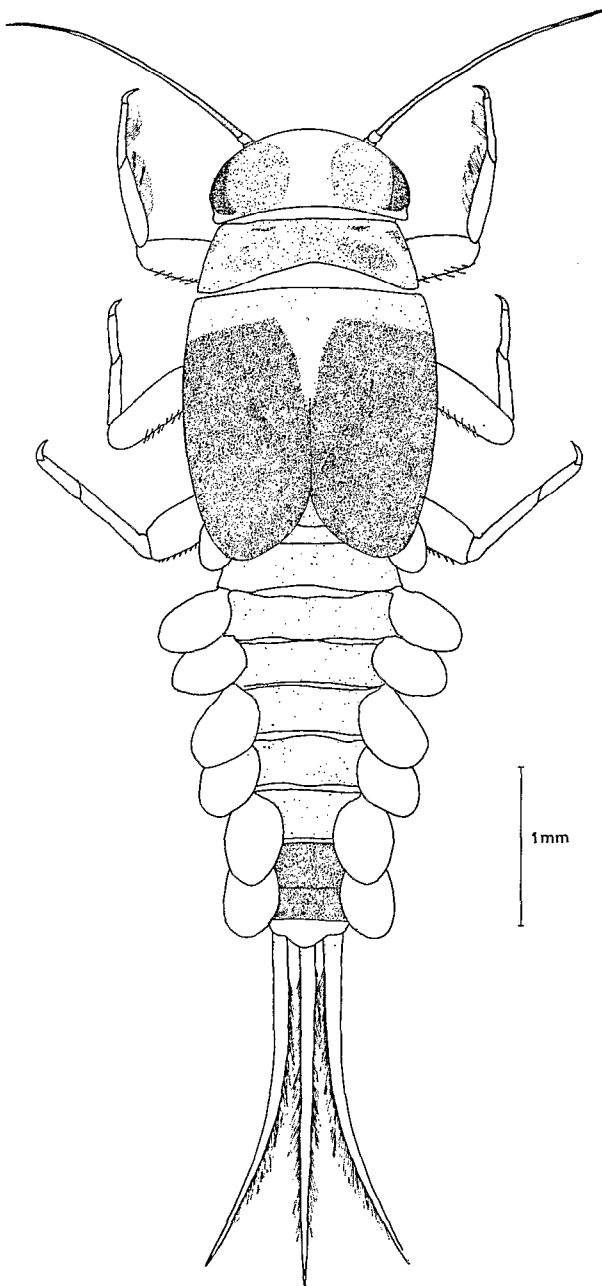


FIG. 14. — Nymph of *Pseudopannota muganinani*.  
Larve de *Pseudopannota muganinani*.

Type material: Niandan River at Sassambaya (Niger basin, Guinea), 7-8/04/88, holotype ♂ and associated nymph skin (ref. E24-11) {in Museum national d'histoire naturelle de Paris}. Paratypes, see below under geographical distribution.

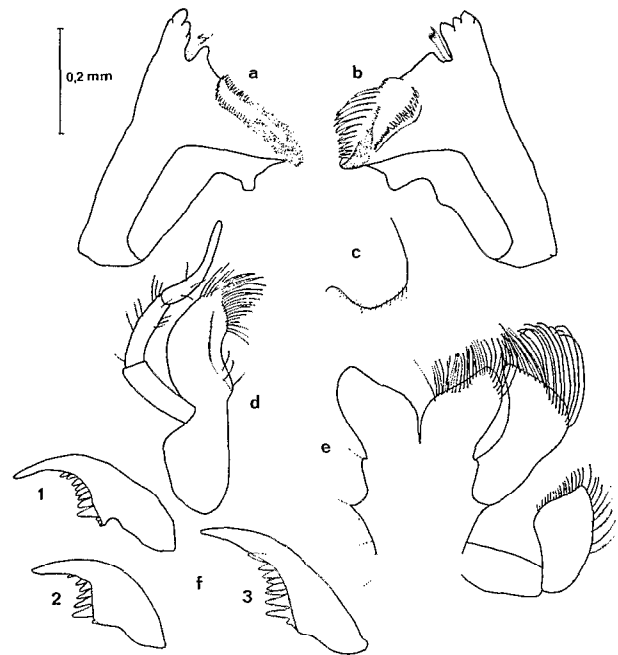


FIG. 15. — *Pseudopannota muganinani*. Mouthparts of the nymph. a : right mandible, b : left mandible, c : labrum, d : left maxilla, e : labium, f : claws.

*Pseudopannota muganinani*. Pièces buccales de la larve. a : mandibule droite, b : mandibule gauche, c : labre, d : maxille gauche, e : labium, f : griffes.

Much data available come from permanent running waters in the dry season in the Guinea savanna (R. Niandan), where nymphs were most abundant in the middle of the dry season at the beginning of March. Nymphs were mostly found under stones, being most abundant in channels with a moderate current in the range from 0.6 to 1 ms<sup>-1</sup>.

#### GEOGRAPHICAL DISTRIBUTION

This species appears to be present in all the rivers of the sudanese and guinean savannas as well as in large rivers in the forest zone. Thus, its distribution broadly overlaps that of *P. bertrandi*. It is, however, a much less abundant species.

*Niger basin*: Milo River at Boussoulé (G.): 18/IV/86, 8 ♂ i.; 22/III/86, 4 NN. Niger River at Bamako (M.): 14/IX/84, 1 ♂ i. Niandan River at Sassambaya (G.): 19/IV/86, 2 NN; 6/III/88, 1 ♀ s.i.; 7/III/88, 7 ♂ i., 2 ♂ s.i.; 5/4/88, 1 ♂ i.; Bagaoé River at Kouto (C.I.): 17/VIII/76, 1N. *Senegal basin*: Bakoye River at Kokofata (M.): 21/XI/84, 2 NN. *Kolente basin*: Kolente River at Simbareya (G.): 3/II/89, 5 ♂ i. *Koumba basin*: Koumba River at Gaoual (G.): 29/I/89, 1 ♂ i. *Bandama basin*: Maraoué River at Entomokro (C.I.): 10/I/79, 5 NN. *Seli basin*: Seli River at Yrafilaia (S.L.): 10/II/89, 2 ♂ i. *St. Paul basin*: Diani River at N'Zébéla (G.), 31/I/88, 3 NN.

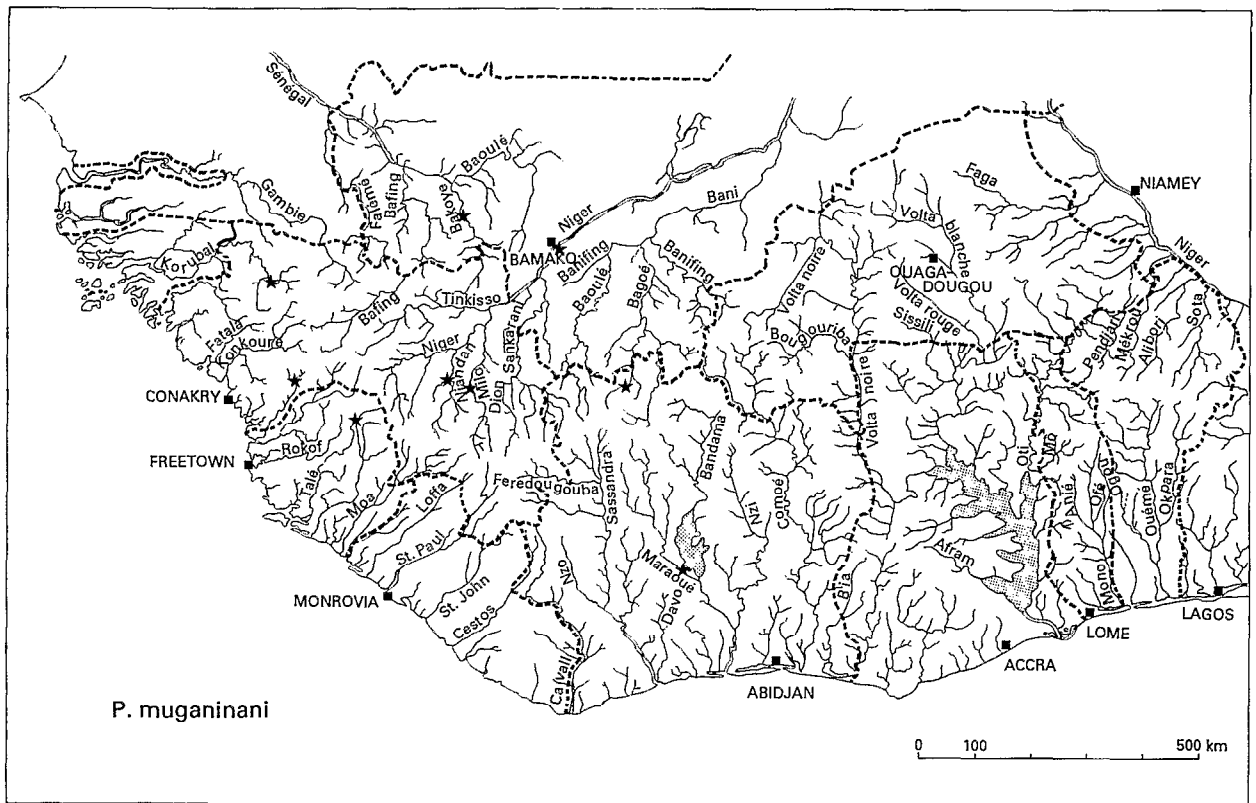


FIG. 16. — Map of distribution of *P. mugarini* in West Africa.  
Carte de distribution de *P. mugarini* en Afrique de l'Ouest.

*Pseudopannota (P.) vinckei* (Demoulin, 1973)

*Pseudocloeon vinckei*, DEMOULIN, 1973, *Bull. Inst. r. Sci. nat. Belg.* 49 (7) : 6.

*Pseudopannota vinckei*, WALTZ et McCAFFERTY, 1987, *Proc. Entomol. Soc. Wash.*, 89 (1) : 96.

This species is only known Madagascar. Given the high degree of endemicity of the fauna of the island, it seems highly unlikely that it will be found in continental Africa. We therefore refer the reader to DEMOULIN'S description cited above.

**Subgenus *Hemipannota* subgen. nov.**

Type species of the subgenus : *P. (H.) maculosa*.

*Pseudopannota (H.) maculosa* (Crass) comb. nov.

*Pseudocloeon maculosum*, CRASS, 1947, *Ann. Natal Mus.* 11: 63.

*Pseudocloeon* sp., CRASS, 1947, *Ann. Natal Mus.* 11 : 64.

*Pseudocloeon* sp., KIMMINS, 1955, *Ann. Mag. nat. Hist.* (12) 8 : 866.

*Pseudocloeon* sp. (Kimmings, 1955), AGNEW, 1963, *Hydrobiol.* 22: 43.

*Pseudocloeon maculosum* Crass, 1947, DEMOULIN, 1970, *Sth. Afr. Anim. Life*, 14. 24-170.

*Pseudocloeon maculosum*, HARRISSON and HYNES, 1988, *Arch Hydrobiol./Suppl.* 81 (1): 18.

*Pseudocloeon* sp., BARNARD and BIGG, 1988, *Rev. Hydrobiol. trop.*, 21 (2) : 131.

CRASS (1947) described *Pseudocloeon maculosum* from Natal (South Africa) on the basis of a single imago. At the same time, he gave a description of a very distinctive nymph under the same *Pseudocloeon* sp., which he suspected might be that of *P. maculosum*. HARRISSON was later able to confirm this suspicion by the rearing of nymphs he collected at Chimanimani, Zimbabwe (HARRISSON and HYNES, 1988). The same authors listed this species as a characteristic member of the fauna of highland streams at altitudes of 1700-3500 m in central Ethiopia.

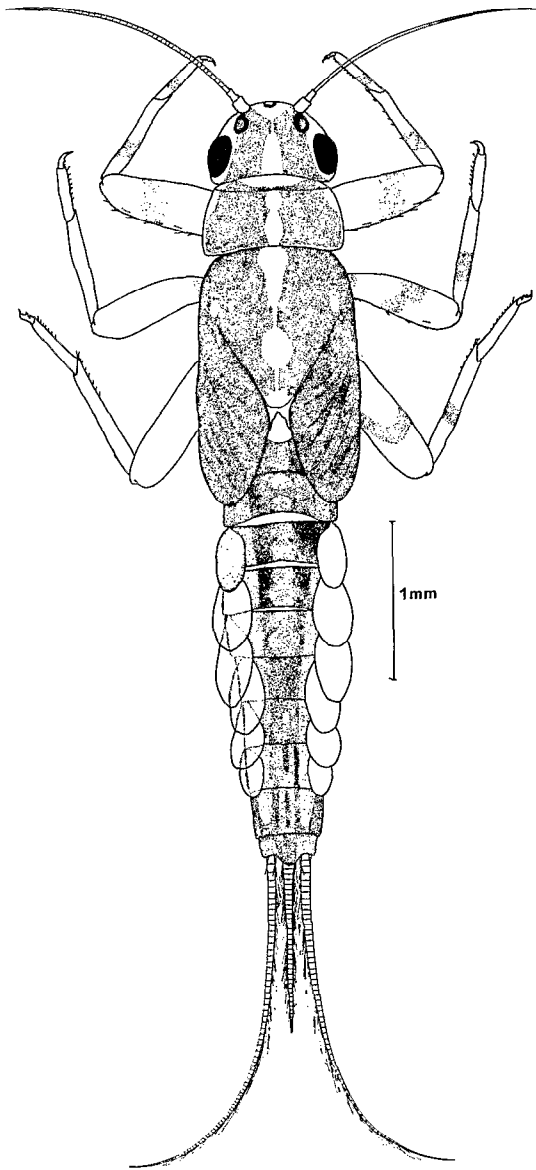


FIG. 17. — *P. modesta* nymph dorsal view.  
*P. modesta* vue dorsale.

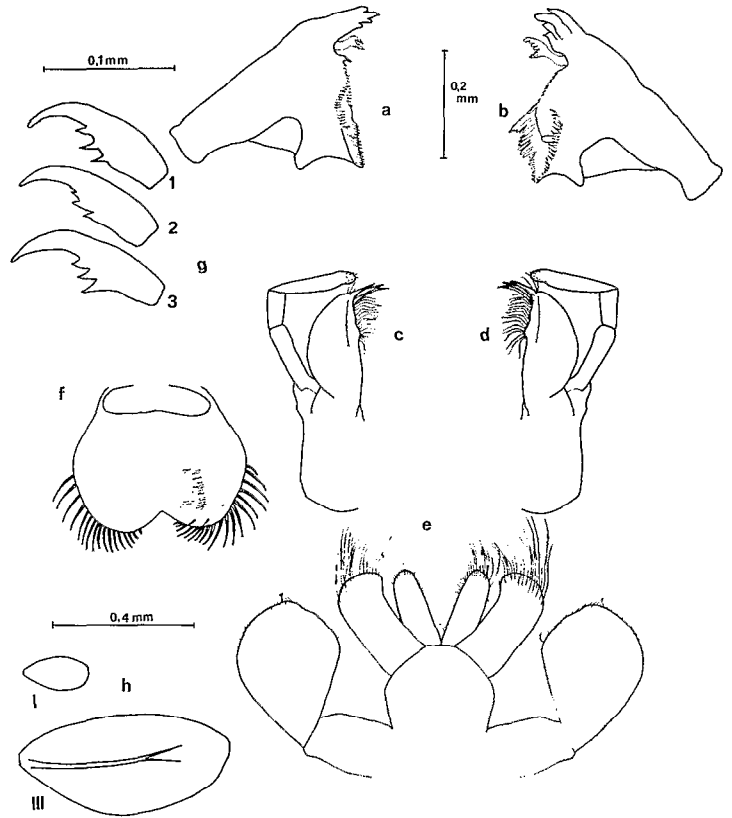


FIG. 18. — *P. modesta* mouthparts of the nymph. a : right mandible, b : left mandible, c : left maxilla, d : right maxilla, e : labium, f : labrum, g : claws, h : *P. maculosa*, gill I and III. *P. modesta* : Pièces buccales de la larve. a : mandibule droite, b : mandibule gauche, c : maxille gauche, d : maxille droite, e : labium, f : labre, g : griffes, h : *P. maculosa*, branchies I et III.

BARNARD and BIGGS (1988) recorded the presence of two nymphs of "*Pseudocloeon* sp. Grass" in streams in the catchment area of Lake Naivasha at an altitude of about 1900 m in the rift valley of Kenya. We have examined these nymphs as well as HARRISON's material from Zimbabwe, which enables us to confirm the identity of the specimens from Kenya. Similarly we examined the nymphs from Malawi recorded by KIMMINS (1955) as "*Pseudocloeon* sp.". Again, they are typical from *P. maculosa*.

GRASS did not mention the condition of gill I in his description of the nymph from Natal. However, in all the specimens from Zimbabwe and Kenya this is only about 1/3 the length of gills II-VII (fig. 18 h). The tarsal claws of the nymphs from Zimbabwe have four denticles and from Kenya 4-5 denticles. GRASS figured three denticles only in his specimens. Given the wide distribution of the species, this degree of variation is not considered significant.

#### *Pseudopannota* (*H.*) *modesta* sp. n., Elouard and Gillies

Nymph. Body with variable pale markings on a brown or green background; when developed to the maximum extent consisting of a median pale stripe extending for the entire body (fig. 17). At the other extreme, markings reduced to ill-defined pale areas

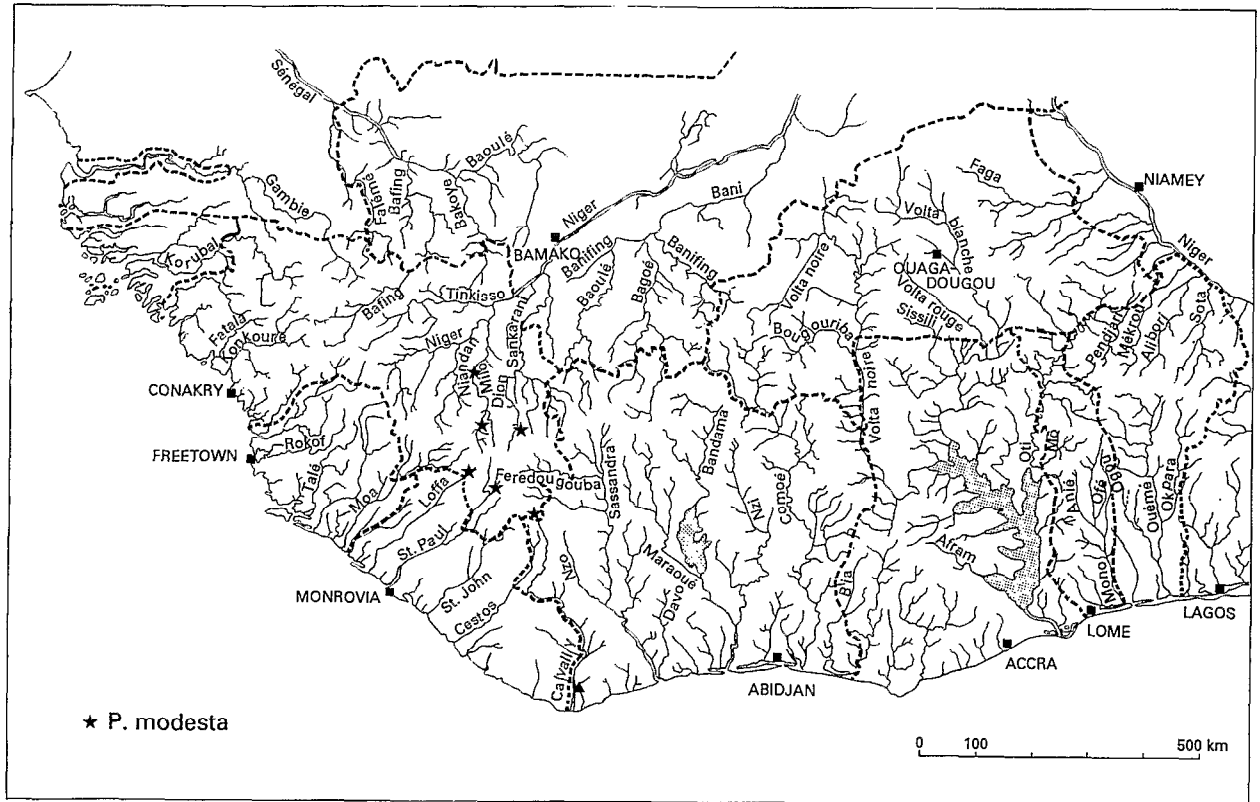


FIG. 19. — Map of distribution of *P. modesta* in West Africa.  
 Carte de distribution de *P. modesta* en Afrique de l'Ouest.

over bases of wings buds and small median patches on terga IV-V; tergum X pale overall. Femora pale with a broad greenish-brown transverse band about 2/3 the distance to apex, on the fore femur this band extending rather more broadly towards the base.

Mouthparts (fig. 18): anterior margin of labrum with a line of stout setae overlapping anterior shelf; mandibles with a small projection at bases of prosthecae, outer portion of right molar region with a tuft of projecting spines; glossae and paraglossae of labium with more or less parallel sides except at extreme apex.

Wings buds fused at base only, the point of fusion marked by a small median notch. Posterior margins of femora with a row of stout, blunt setae; tibiae and tarsi without dorsal fringe of long hairs; tarsal claws with 3-4 teeth. Gills presents on segments II-VII, ovaten with serrated margins and spiculate surface. Tails unbanded; terminal filament 1/2-2/3 length of cerci.

Body (with developed wing cases but not last instars) 5 mm.; tails 3 mm.

Type material: Holotype nymph, Gambia River at Mako (Sénégal), 28.II.1983 {in MNHN, Paris}; paratypes: see under distribution.

This species differs from *P. (H.) maculosa* by the absence of the first gill and the reduced number of teeth on the tarsal claws.

#### GEOGRAPHICAL DISTRIBUTION

*P. modesta* appears to be purely a West African species, occurring at low altitudes in fast-flowing stony rivers in forest-savanna mosaic area (fig. 19).

*Niger basin*: Milo River at Boussoulé (G.), 25/I/86, 1 N.; Léléko River at Konsankoro (trib. Milo, G.), 8/III/1988, 1 N.; tributary Kouan, Tambicola-Beyla area (G.), 11/III/88; 2 NN.; *Cavally basin*: Cavally River at Oueyakollé (G.), 2/II/1988, 4 NN.; *Loffa basin*: Loffa at Macenta River (G.), 30/I/88, 1 N.; *St. Paul basin*: Loffa River near Boola (G.), 8/III/88, 1 N.; *Rio Corubal basin*: Tomine River at Téliélé (G.), 27/I/87, 1 N.

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