Description of the genus *Alona* Baird, 1843 (Crustacea : Anomopoda : Chydoridae) from the rainforest of Cameroon, Central-West Africa.

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ABSTRACT

Examination of 700 samples from freshwater habitats of the Cameroon rainforest reveals 7 species of the genus *Alona* : *Alona affinis, A. guttata, A. costata, A. verrucosa, A. intermedia, A. rectangula* and *A. monocantha.* The morphology of these species is herein described and figured. All share a common feature at the level of the spine (0-0-3/1-1-3) and setal (1-0-1/0-0-1) furmulae respectively. They show differences in the valves, headshield, position of ocellus with respect to the eye, first and second antenna, labral plate, postabdomen and postabdominal claw. Comparison is done with past records from some other African rainforests (Nigeria and Congo). The total diversity is similar for Cameroon and Nigeria (7 species each) but slightly lower for Congo (9 species) and a single species (*Alona affinis*) common to all three rainforests. Possible reasons for these differences are herein discussed.

Key words : *Alona,* headshield, antenna, valve, postabdomen.

RESUMÉ

700 échantillions provennant des eaux douce de la foret dense du Cameroun ont été analysés. Les résultat enregistre 7 espèce du genre Alona: *Alona affinis, A. guttata, A. costata, A. verrucosa, A. intermedia, A. rectangula et A. monocantha.* La morphologie des èspèces sont décrites et figurés. Ces èspèces partage les memes formule épinaires (0-0-3/1-1-3) et soies antennaires (1-0-1/0-0-1). Elles se distingues par les valves, capsules cephaliques, la position de l'ocelle par rapport à l'œil, l'antennule et l'antenne, le labre, postabdomen et la griffe terminale. Les résultats sont comparés avec celles de foret dense de quelques pays Africain (Nigeria et Congo). La diversité total est la meme pour le Cameroun et le Nigeria (7 èspèces chacun) mais un peu plus élevée pour le Congo (9 èspèces) avec une suel èspèce (*Alona affinis*) commun pour tous les trois forets. Les raisons possible pour cette différence sont ici discuté.

Mots clés : *Alona*, capsules cephaliques, antenne, valve, postabdomen

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INTRODUCTION

Crustacea cladocerans (Branchiopoda : Anomopoda/Ctenopoda) are widespread in the plankton and littoral microfauna of freshwater habitats. Although the term "Cladocera" has no systematic validity (Fryer, 1987 ; Dodson & Frey, 1991), we prefer to use this term because it is familiar. The genus *Alona* belongs to the family Chydoridae/subfamily Aloninae and contains many more species than any other genus of the Chydoridae. This subfamily is characterised by having a mandible that articulates with the integument between the headshield and valves; two to three main pores, situated in the median line of the headshield and small pores situated lateral to them; claws with a single basal spine and sometimes without basal spine and anus situated in the proximal part of the postabdomen. It contains about 15 genera and more than 100 species. Chiambeng and Dumont (2004) already examined the species composition of the genus *Pleuroxus* (Cladocera : Chydoridae) of the Cameroon rainforest. This contribution examines the species composition of the genus *Alona* from a wide range of freshwater habitats in this same environment.

EXPERIMENTAL

- Field survey and materials examined

About 700 samples were collected between September 1997 and September 2002 from all over the rainforests in Cameroon: Mt. Cameroon, Bakundu, Korup, Kupe Manengouba, Douala-Edea, Campo-Ma'an, Dja, Boumba-Bek, and Mbalmayo rainforests. A plankton tow-net and a hand net were used respectively. The tow-net consisted of an iron ring with diameter 20cm attached to a nylon rope of 6cm length. A plankton net mesh size 100μm and length 25cm was mounted on this ring and provided with a 60ml plastic recipient at the end. The hand-net consisted of a rectangular metal ring (15x20cm) mounted on a solid iron rod 1.5m long

Table 1 : Morphological differences between the Cameroon rainforest *Alona*

Character	*Alona affinis*	*Alona guttata*	*Alona costata*	*Alona rectangula*	*Alona verrucosa*	*Alona monocantha*	*Alona intermedia*
Postero-ventral corner	No denticle	idem	idem	idem	idem	1-3 denticles	No denticle
Head shield	2 headpores + 2 small pores close to anterior pore	3 head pores + 2 small pores closer to middle pore	3 headpores+ 2 lateral pores in transverse slits close to anterior	3 head pores + 2 small pores closer to middle pore	2 headpores + 2 small pores close to anterior pore	3 headpores+ 2 lateral pores in transverse slits close to anterior	2 headpores + 2 small pores close to anterior pore
Ocellus	Close to eye	idem	Halfway between eye and tip of rostrum	Close to eye	Halfway between eye and tip of rostrum	idem	Halfway between eye and tip of rostrum
Labral plate	Undulate anterior margin	Posterior edge setulated	idem	Rounded anterior margin	With anterior denticle	idem	Posterior edge setulated
First antenna	With 2 lateral setaee	1 seta	idem	idem	idem	idem	1 seta
Second antenna	Denticulated, exopod with cluster of spines	exopod with cluster of spines	idem	idem	idem	No spines on exopod	idem
Postabdomen	Uniformly widened ; 12 anal denticles ; 15 fascicles	9 anal denticles ; 8 fascicles	Tapering distally ; 11 anal 9 fascicles	Tapering distally ;8 anal denticles ; 8 fascicles	Short ; 6 anal denticles ; 9 fascicles	Short, ;7 anal denticles ; 7 fascicles	Widened distally ; 10 anal denticles ; 10 fascicles
Claw	Basal spine 1/3 claw length	Basal spine ¼ claw length	idem	Basal spine 1/3 claw length	idem	Basal spine 1/2 claw length	Basal spine 1/3 claw length

with a plankton net of mesh size 100μm and a 60ml recipient at the tail end. All concentrated samples were collected by horizontal and vertical hawls, then fixed by diluting with 40% formaldehyde solution up to 5% concentration.

Analysis of samples

Sorting and identification was done using a stereozoom dissection microscope (WILD). Specimens were then mounted on slides, a few drops of glycerine added and semi-permanently sealed with glyceal. Identifications were done under oil immersion using an Olympus CO11 compound microscope and available literature: Smirnov (1971a, 1996, 1992a), Alonso (1996).

RESULTS

Alona affinis **(Leydig, 1860)** (Figure 1)
Material examined: 2 specimens from the Manyu river below the bridge in Mamfe, 12/04/01 ; 1 specimen from the river Nyong flood plain in Mbalmayo, 13/07/98.

Material figured : 1 parthenogenetic female from the Manyu river, Mamfe.

Description : Body semi-circular in lateral view, maximum height in the middle (length : 0.70mm ; height : 0.38mm). Valves (Fig. 1F & G) with longitudinal striations;postero-dorsal and postero-ventrral corners rounded, ventral margin almost straight. Headshield (Fig. 1E) with two connected main pores and two small lateral pores on both sides of anterior pore. Ocellus smaller than compound eye (Fig. 1A), located closer to eye than apex of rostrum; labral plate (Fig. 1D) with undulate margin. First antenna (Fig. 1B) with nine aesthetascs, and two lateral setae: proximal long, about a third the distance from the base and distal small about half distance from the tip; second antenna (Fig. 1C) directed posteriad and denticulated; setal furmula 0-0-3/1-1-3 ; spine furmula : 1-0-1/0-0-1.
Postabdomen (Fig. 1H) uniformly widened with distinct pre-anal, rounded dorso-distal corner and twelve anal denticles attached submarginally, with all serrated along proximal margin and continue with four groups of spinules along the anal groove. Fifteen fascicles of setules are present laterally with distal-most longest of each fascicle and first seven slightly projecting beyond anal margin. Claw (Fig. 1H) with long basal spine with five short spinules at its base. Concave surface of claw setulated.

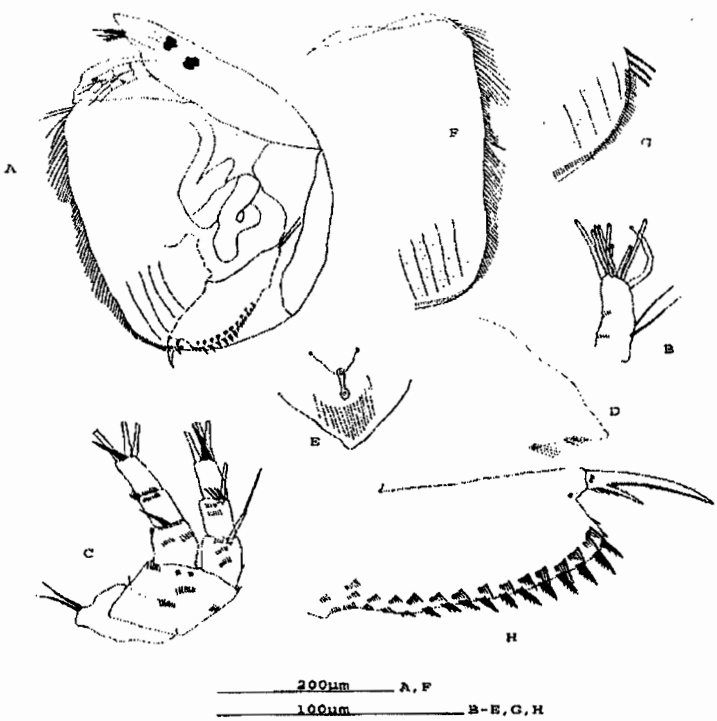

Figure 1: *Alona affinis.* Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headshield (E), ventral margin (F), postero-ventral corner (G), postabdomen (H).

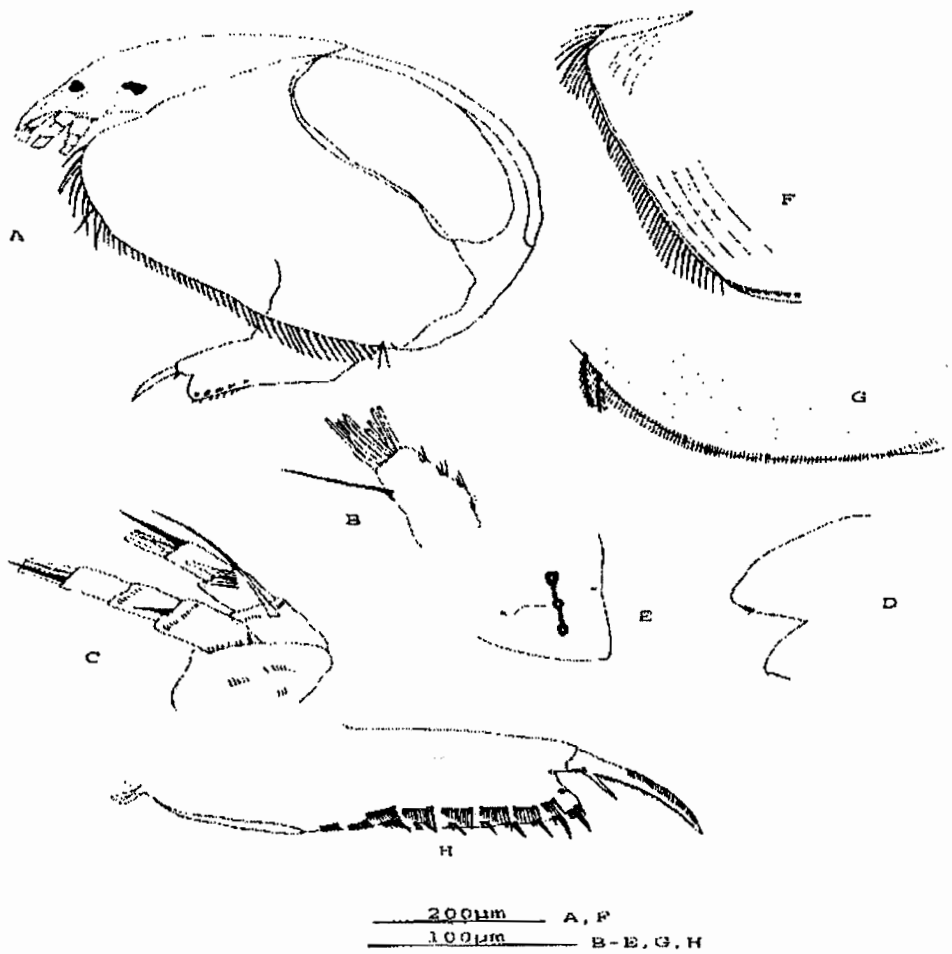

Figure 2: *Alona guttata.* Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headshield (E), ventral margin (F), postero-ventral corner (G), postabdomen (H).

Alona guttata **Sars, 1862.** (Figure 2)

Material examined : 2 specimens from the Manna bridge Korup National Park, Mundemba, 13/03/02 ; 2 specimens from the Municipal lake in Yaounde, 20/03/02.

Material figured :1 parthenogenetic female from Manna bridge, Korup Park.

Description : Rounded in body outline (length : 0,48mm ; height : 0.37mm)(Fig. 2A). Valves (Fig. 2 F&G)with longitudinal lines, postero-dorsal and postero-ventral corners rounded. Headshield (Fig. 2E) with three connected headpores and two lateral pores on both sides of middle pore. Ocellus smaller than compound eye and located closer to eye than apex of rostrum. Labral plate (Fig. 2D) anteriorly rounded and with setules at posterior edge. First antenna (Fig. 2B) with nine terninal aesthetascs, a lateral seta arising from about a third distance from tip and three rows of spinules laterally. Second antenna(Fig. 2C), setal formula : 0-0-3/1-1-3 ; spine formula : 1-0-1/0-0-1. Terminal spines long and thin ; cluster of thin spinules laterally on exopod.

Postabdomen (Fig. 2H) with indistinct pre-anal and distinct post-anal corners and slightly wider at post-anal corner. About nine denticles attached submarginally each followed with short spinules. Eight fascicles of setules present laterally, distalmost longest. Claw with relatively short basal spine about a quarter claw length; inner margin with spinules; base of claw with 3-5 spinules.

Alona costata **G.O.Sars** (Figure 3)

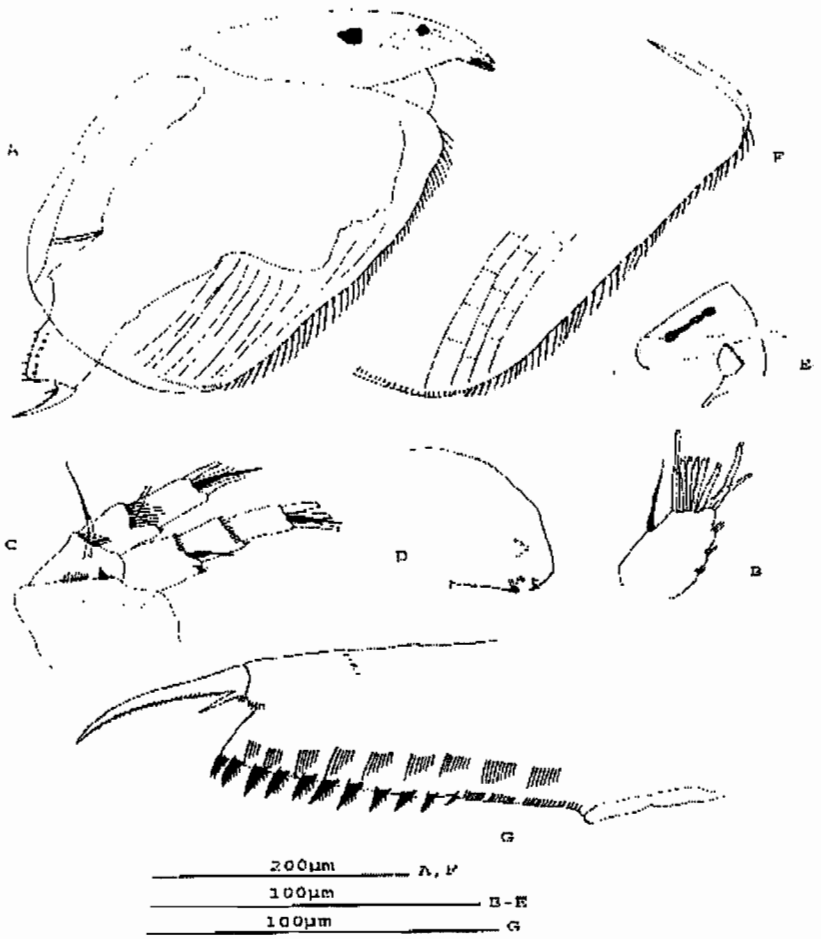

Figure 3: *Alona costata*. Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headshield (E), ventral margin (F), postabdomen (G).

Material examined and Figured : 1 parthenogenetic female fom Municipal lake Yaounde, 20/03/02.

Description : Rounded in body outline (length : 0.38mm ; height : 0.24mm)(Fig. 3A). Valves with longitudianl lines, postero-dorsal and postero-ventral corners rounded. Headshield (Fig. 3E) with three connected median pores, two small lateral pores form transversely elongated slits situated closer to anterior pore. Ocellus smaller than compound eye and located halfway between eye and rostrum (Fig. 3A). Labral plate rounded anteriorly, posterior edge with setules(Fig. 3D). First antenna with nine terminal aesthetascs (Fig. 3B), lateral seta arises from apical notch about a third distance from tip; three rows of spinules present laterally. Second antenna setal formula: 0-0-3/1-1-3; spine furmula: 1-0-1/0-0-1 (Fig. 3C). Terminal spines long and thin; cluster of thin spinules laterally on exopod.

Postabdomen (Fig. 3G) with distinct pre-anal, indistinct post-anal corners and eleven denticles attached submarginally. Anal groove bordered with rows of spinules; nine fascicles present laterally, distal setule longest of each group. Claw with relatively short basal spine, about a quarter its length. Inner margin of claw spinulated, base of claw proximal to basal spine with a row of spinules.

Alona rectangula **Sars, 1862** (Figure 4)

Material examined : 3 specimens from Lake Debundscha, 07/7/99 ; 1 specimen from river Dafan along footpath to Rengo camp from N-transect, 13/06/99.

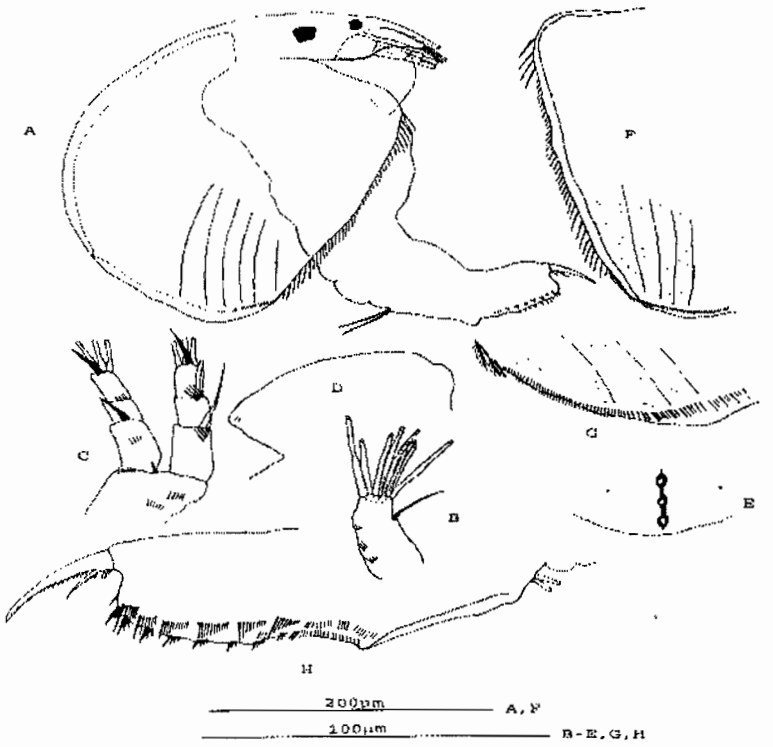

Figure 4: *Alona cf. rectangula*. Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headshield (E), ventral margin (F), postero-ventral corner (G), postabdomen (H).

Material figure : 1 parthenogenetic female from Lake Debundscha.

Description : Slightly rounded in dorsally, almost straight ventrally (length : 0.33mm ; height : 0.22mm) (Fig. 4A). Valves with longitudianl lines, postero-ventral corners rounded. Headshield (Fig. 4E) with three connected median pores, two small lateral pores closer to middle pore. Ocellus smaller than compound eye and located closer to eye than apex of rostrum; labral plate (Fig. 4D) rounded anteriorly. First antenna with nine terminal aesthetascs, lateral seta arises from apical notch about a third distance from tip; three rows of spinules present laterally(Fig. 4B). Second antenna setal formula : 0-0-3/1-1-3; spine furmula : 1-0-1/0-0-1(Fig. 4C). Terminal spines long and thin ; cluster of thin spinules laterally on exopod.

Postabdomen (Fig. 4H) relatively short, with distinct pre-anal and post-anal corners and eight groups of denticles attached submarginally. Anal groove bordered with three rows of spinules, eight fascicles present laterally, distal setule longest of each fascicle. Claw with relatively short basal spine, about a third the length of claw and with setules at base. Inner margin of claw spinulated; base of claw proximal to basal spine with a row of spinules.

Alona verrucosa **Sars, 1901** (Figure 5)

Material examined : 3 specimens from Yoke river Muyuka at level of bridge, 25/7/2000 .

Material figured : 1 parthenogenetic female from Yoke river Muyuka.

Description : Valves slightly rounded dorsally, almost straight ventrally with maximum height in middle (length : 0.32mm ; height : 0.21mm); postero-ventral corners rounded. Headshield (Fig. 5E) with two connected median pores, and two large bi-lobed lateral pores on both side of anterior pore. Ocellus smaller (Fig. 5A) than compound eye and located about same distance to eye as apex of rostrum. Labral plate rounded anteriorly and with denticle (Fig. 5D). First antenna with nine terminal aesthetascs, lateral seta arises from apical notch about a third distance from tip; two rows of spinules present laterally (Fig. 5B). Second antenna setal formula : 0-0-3/1-1-3; spine furmula : 1-0-1/0-0-1. Terminal spines long and thin, cluster of thin spinules laterally on exopod (Fig. 5C).

Postabdomen (Fig. 5G) short, with distinct pre-anal and post-anal corners; six anal denticles attached submarginally each followed by groups of spinules.

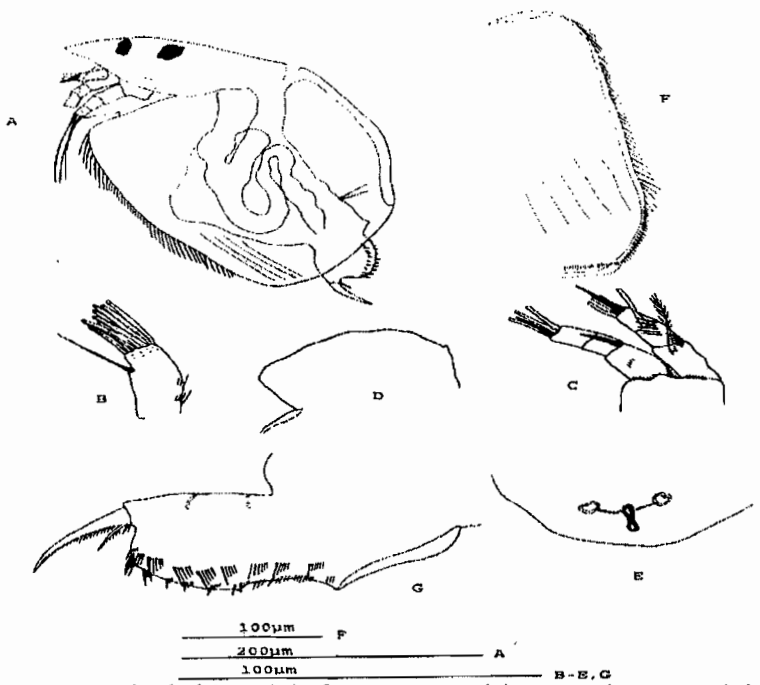

Figure 5: *Alona cf. verrucosa*. Female: habitus (A), first antenna (B), second antenna(C), labrum (D), headshield (E), ventral margin (F), postabdomen (G).

Anal groove bordered with three rows of spinules. Nine fascicles present laterally, distal setule longest of each group. Claw with relatively short basal spine, about a third its length and with setules at base. Inner margin of claw spinulated, base of claw proximal to basal spine with of spinules, inner surface of basal spine setulated.

Alona monocantha Sars, 1901(Figure 6)
Material examined: 1 specimen from River Oto' Ovam at Adjap village (Campo-Maan forest) close

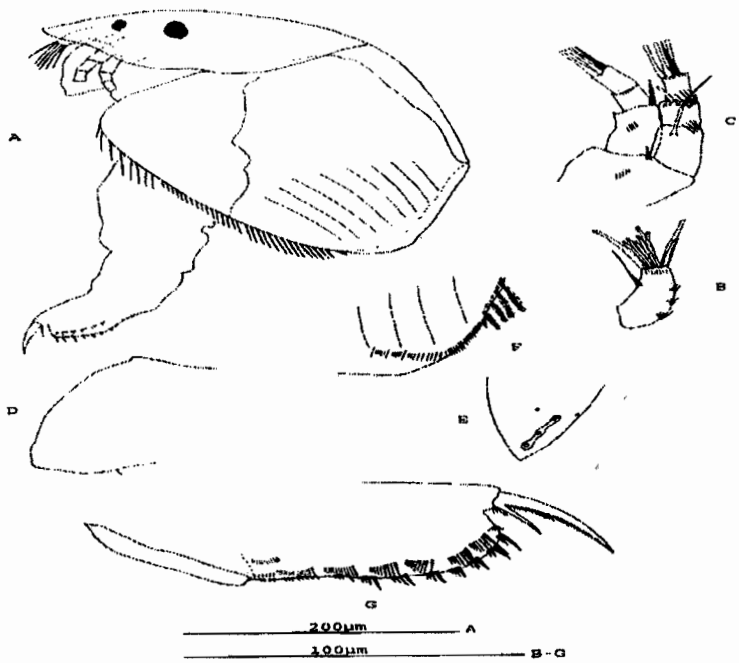

Figure 6: *Alona cf. monacantha*. Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headshield (E), postero-ventral corner (F), postabdomen (G).

to the bridge, 7/08/01 ; 2 specimens at swamp at Mawoutou camp between Ekona and Muyuka Mount Cameroon forest , 1/08/99 .

Material figured : 1 parthenogenetic female from swamp at Mawoutou camp.

Description : Valves slightly rounded dorsally, almost straight ventrally with maximum height in middle (length : 0.35mm ; height : 0.27mm) ; postero-ventral corners rounded and with 1-3 dentcles(Fig. 6A & F). Headshield with three connected median pores, and two lateral pores on both side of anterior pore (Fig. 6E). Ocellus smaller than compound eye and located about same distance to eye as apex of rostrum. Labral plate rounded anteriorly and with denticle. First antenna with nine terminal aesthetascs, lateral seta arises from apical notch about a third distance from tip, three rows of spinules present laterally (Fig. 6B). Second antenna setal formula : 0-0-3/1-1-3; spine furmula : 1-0-1/0-0-1. Terminal spines long and thin, cluster of thin spinules laterally on exopod (Fig. 6C).

Postabdomen short, with distinct pre-anal corner; seven anal denticles attached submarginally each followed by groups of spinules (6G). Anal groove bordered with three rows of spinules. Seven fascicles present laterally, distal setule longest of each group. Claw with relatively long basal spine, about half its length and with setules at base. Base of claw proximal to basal spine with of spinules.

Alona intermedia **Sars, 1862** (Figure 7)

Material examined and figured: 1 specimen from Nyabo stream along footpath to Research station Somalomo, Dja forest reserve, 08/99 ; 1 specimen at Abat village from river behind community hall , Korup forest 15/06/99 .

Description : Body slightly curved dorsally, (length : 0.48mm ; height : 0.31mm)(Fig. 7A). Valves with longitudianl striations, postero-ventral corners rounded. Headshield with two connected median pores, two lateral pores close to anterior pore (Fig. 7E). Ocellus smaller than compound eye and located about halfway between eye and apex of rostrum. Labral plate rounded anteriorly and with group of setules posteriorly (Fig. 7D). First antenna with nine terminal aesthetascs, lateral seta arises from apical notch about a third distance from tip, two

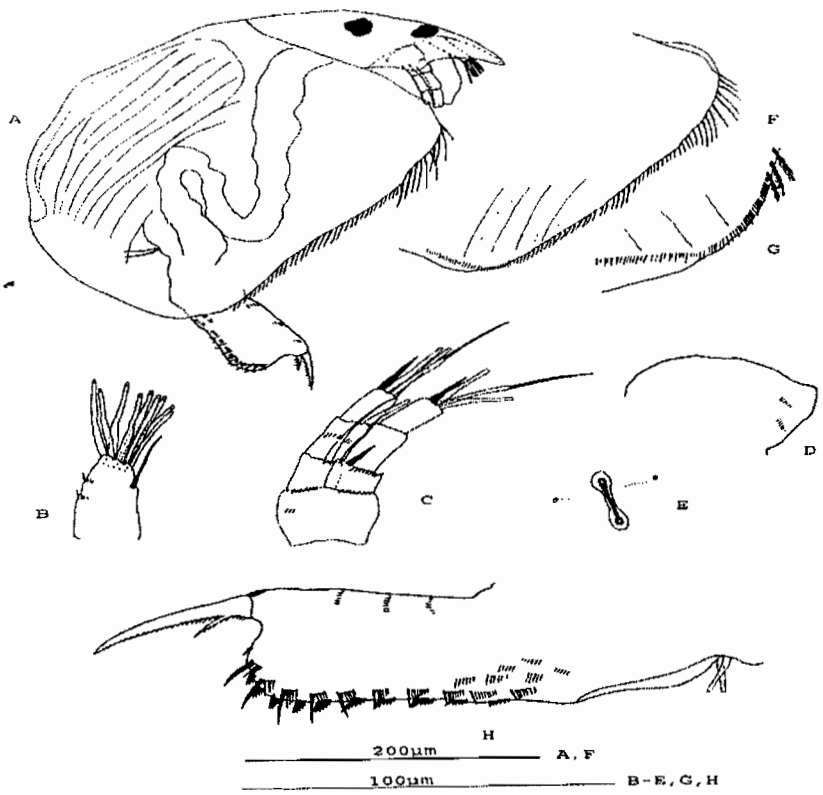

Figure 7: *Alona intermedia*. Female: habitus (A), first antenna (B), second antenna (C), labrum (D), headpores (E), ventral margin (F), postero-ventral corner (G), postabdomen (H).

rows of spinules present laterally (Fig. 7B). Second antenna setal formula : 0-0-3/1-1-3; spine furmula : 1-0-1/0-0-1(Fig. 7C).

Postabdomen expanded distally(Fig. 7H), with distinct pre-anal corner and indistinct post-anal cornert; ten anal denticles attached submarginally each followed by groups of spinules; ten fascicles present laterally, distal setule longest of each group. Claw with short basal spine, about a third its length and with setules at base; inner surface of claw setulatad.

DISCUSSION

We see from table 1 that the Cameroon rainforest *Alona* could be separated morphologically mainly by the presence or absence of spines at the posteroventral corner, the number and alignment of headpores, the nature of the labral plate, first and second antenna and lastly the ornamentation of the postabdomen and the basal spine/claw ratio. The major headpores are median, 2 or 3 in number and with 2 porules either close to anterior or middle pore ; the labral plate is rounded or undulated anteriorly and sometimes with an anterior denticle and setules at the posterior edge ; the first antenna is with 1 or 2 setae and the second antenna in most cases bears spines on the exopod ; the morphology and ornamentation of the postabdomen is very varied and the basal spine/claw ratio is either 1 :2, 1 :3 or 1 :4. This genus is also well known in other African rainforests. Egborge et al. (1994), reported 7 species *: Alona quadrangularis, A. pulchella, A. affinis, A. holdeni, A. rectangula, A. alonopsoiddes, A. diaphana* for Nigeria; Korinek (1984), reported 9 species : *Alona pulchella, A. sarasinorum, A. affinis, A. setigera, A. guttata, A. verrucosa, A. monocantha, A. intermedia* and *A. diaphana* for Congo. *Alona affinis* is the only common species to all three. These differences in species composition may be linked to differences in micro-habitats present in each of the rainforests. The fact that the rainforests of Nigeria and Congo have not been adequately sampled compared with Cameroon still leaves much to be uncovered in these two regions.

CONCLUSION

We conclude here that the genus *Alona* is well represented in the Cameroon rainforest recording 7 species with well pronounced external morphological differences. The use of limb morphology as a taxonomic and phylogenetic tool will be required for further separation and more detailed description of these species.

ACKNOWLEDGEMENT

The authors thank the Belgian technical Cooperation for financial assistance, also Kay Van Damme of the Department of Biology University of Gent, for practical assistance.

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Received: 02/10/2004
Accepted: 20/02/2005