

Redescription of a South American cladocera, *Alona monacantha* Sars, 1901 (Branchiopoda: Anomopoda: Chydoridae)

Переописание южно-американского ветвистоусого ракообразного *Alona monacantha* Sars, 1901 (Branchiopoda: Anomopoda: Chydoridae)

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КЛЮЧЕВЫЕ СЛОВА: *Alona monacantha*, ветвистоусые раки, систематика, морфология, распространение.

ABSTRACT. The South American cladoceran *Alona monacantha* Sars, 1901 is redescribed from G.O. Sars' type material. Detailed morphology of this species is provided for the first time. Analysis of morphology shows that *A. monacantha* is closely related to Paleartic *Alona rectangula* Sars, 1862. Distribution of *A. monacantha* and its position within the genus are discussed.

РЕЗЮМЕ. Южно-африканский ветвистоусый рак *Alona monacantha* Sars, 1901 переописан по типовому материалу. Впервые проведено детальное исследование морфологии вида. Анализ морфологии показывает, что вид *A. monacantha* близок к палеоарктическому виду *Alona rectangula* Sars, 1862. Обсуждаются распространение вида *A. monacantha* и его позиция внутри рода.

Introduction

The South American cladocera *Alona monacantha* Sars, 1888 was described by G.O. Sars among other cladocerans grown from dried mud from the neighborhoods of Ipiranga and Sao-Paulo, Brazil. Sars gave a quite detailed description of the general morphology and postabdomen of the parthenogenetic female, accompanied by three drawings (lateral view of female, postabdomen, and posteroventral corner of valves) [Sars, 1901, 54–55, Pl. 9, Fig. 5a–b]. He stated: “**This form, at first sight, looks very like the European species, *A. rectangula* G.O. Sars, both in size and general appearance. On a closer examination, however, it is found to differ in the shape and armature of the caudal part, as also in the presence of a distinct**

dentiform projection on each valve at the infero-posteal corner”. The similarities between *A. rectangula* and *A. monacantha* are obvious, and Daday [1910] even treated *A. monacantha* as a variety of *A. rectangula*.

At present, *A. monacantha* has been recorded from South America [Sars, 1901; Brehm, 1957], North and Central America [Megard, 1967; Smirnov, 1988], Africa [Daday, 1910; Harding, 1957; Rey & Saint-Jean, 1968; Van de Velde, 1978; Dumont, 1981, 1986; Dumont et al., 1981] and South-East Asia [Idris & Fernando, 1981; Sanoamuang, 1998]. Less than half of the above-mentioned authors described the outer morphology of specimens, and the detailed morphology of this species was never studied. Specimens described by Harding [1957] from Lake Tanganyika had tuberculated valves, unlike any other recorded population of this species, and lately Smirnov [1971] separated this form into an independent species, *A. hardingi* Smirnov, 1971. Such a cosmopolitan distribution of *A. monacantha* seems quite doubtful from the modern view of cladoceran taxonomy [Frey, 1982, 1987].

Soon after description of *A. monacantha*, Sars [1903] described a very similar species, *A. acuticostata* Sars, 1903 from Sumatra. The criteria for separation of these two species are obscure, and, like several other taxa described during this period, *A. acuticostata* was immediately dismissed as a synonym, being recognised only by Stingelin [1905], who described a variety of this taxon with two-three denticles on valves as *A. acuticostata* var. *tridentata*. The detailed morphology of *A. acuticostata* has never been studied, and its identity with *A. monacantha* has not been confirmed reliably.

Two samples with specimens of *A. monacantha* were present among Sars' collection of Cladocera de-

posited in Zoological Museum of Oslo University. The aim of this study was to investigate the detailed morphology of *A. monacantha*, and to determine its place within the genus.

Material and Methods

The material studied included two of G. O. Sars' original samples with animals grown from dried mud from Ipiranga, Brazil. Animals were selected from the sample under a binocular stereoscopic microscope, placed on slides (in a drop of a glycerol-ethanol mixture) and studied under an optical microscope. Three adult parthenogenetic females were dissected for the analysis of appendages. Sars did not select a holotype and paratypes, so one adult female from the larger sample was selected as the lectotype, all others specimens from this sample as paralectotypes. All specimens were measured using an eyepiece-micrometer. Drawings were made with a camera lucida.

ABBREVIATIONS. *In the list of material:* ZMOU — Zoological Museum of Oslo University.

In illustrations and text: I–V — thoracic limbs I–V; as — accessory seta of limb I; e1–3 — endites 1–3 of limb I; ep — epipodite; ex — exopodite; IDL — inner distal lobe of limb I; IP — interpore distance (distance between anterior and posterior major head pores); ODL — outer distal lobe of limb I; PP — postpore distance (distance between posterior head pore and posterior corner of head shield); s — sensillum.

Results

Alona monacantha Sars, 1901

Sars, 1901, 54–55, Pl. 9, Fig. 5a–b; Brehm, 1957, 230–237, fig. 1–4; Goulden, 1966: 97, Pl. 2, Fig 1–2, 4–5; Megard, 1967: fig. 7–8.

Type location: Ipiranga, State of São Paulo, Brazil. (Sars had worked with specimens from two locations: "The aquaria in which this form occurred, were prepared with mud, partly from the neighbourhood of São Paulo, partly from Ipiranga." [Sars, 1901, p. 55]. Since only samples from Ipiranga remains in collection, it is convenient to treat Ipiranga as a type locality).

Lectotype: parthenogenetic female, ZMOU, sample F12332a

Paralectotypes: 11 parthenogenetic females, ZMOU sample F12332; 2 dissected parthenogenetic females, mounted on slides, ZMOU slides F12332b,c.

Other material: 6 parthenogenetic females from Ipiranga, Brazil, ZMOU, sample F12333; dissected parthenogenetic female from same location, ZMOU, slide F12333a.

DIAGNOSIS. Female: Body low, length about 1.6–1.7 times maximum height. 35 setae at ventral margin significantly differentiated in size anteriorly and posteriorly. Postero-ventral corner with single denticle. Head shield with broadly rounded posterior margin, rostrum short and rounded. Three major head pores of equal size with a narrow connection between them. PP less than 0.5 IP. Lateral head pores located about 0.8 IP distance from midline, at level between anterior and central major head pore. Labrum with broad keel, with blunt apex, frequently with notch on anterior margin, without any clusters of setules on posterior margin of keel.

Postabdomen of moderate width, with convex dorsal margin, length about 2.3–2.4 height. Distal margin almost straight, distal angle broadly rounded. Dorsal margin with distal part about 1.2. times longer than preanal one, with postanal portion slightly longer than anal one. Preanal angle well expressed, postanal angle not defined. Preanal margin

almost straight. Postanal margin with 5–6 well-developed, sharp, slender denticles. Anal margin with 4–5 groups of marginal setules. 6–7 broad lateral fascicles of long setules, distalmost setule of each fascicle longest, longer than marginal denticles. Postabdominal claw of moderate length, slightly shorter than preanal portion of postabdomen. Basal spine long and slender, about 0.40–0.45 of the claw length.

Antennule with nine terminal aesthetascs, exceeding half length of antennule. Antennal formula, setae 0-0-3/1-1-3, spines 1-0-1/0-0-1. Seta arising from basal segment of endopod projecting beyond tip of distal segment. Spine on basal segment of exopod longer than middle segment. Spines on apical segments longer than apical segments.

IDL of trunk limb I with two setae armed with well-developed denticles distally, 1st IDL seta absent. Exopodite of trunk limb III with six setae, seta 3 being longest. Exopodite IV with six setae. Exopodite V with four setae. Epipodites IV and V with projections two times longer than exopodite itself. Trunk limb VI absent.

Male unknown.

DIFFERENTIAL DIAGNOSIS. *Alonamacrocopa* shares distinctive characters of the *rectangula*-group of *Alona* — small size, characteristic shape and armament of postabdomen, IDL with only two setae, exopodite III with six setae. It differs from other species of the *rectangula*-group by a strong denticle on the posteroventral corner of valves and a longer postabdominal claw.

DESCRIPTION. Parthenogenetic female. In lateral view, body irregular oval, low in juvenile female of instar II (Fig. 1), regular oval, high in adults (Fig. 2–3), moderately compressed laterally. Maximum height at the middle of body. In adults length about 1.6 times maximum height. Dorsal margin weakly curved, depression between head and rest of body absent. Postero-dorsal and postero-ventral angles broadly rounded. Posterior margin convex. A sharp denticle and about 20 very thin setules of equal length at postero-dorsal angle, these setules not organized into groups (Fig. 5–6). A row of about 80 setules along posterior margin on inner side of carapace, these setules not organized into groups. Ventral margin weakly convex to straight, with about 35 setae. Anteriormost 8–10 setae long, next 8–10 setae very short, about 15 posteriormost setae of moderate length, with well-developed setulation. Antero-ventral angle rounded. Carapace with prominent sculpture in shape of longitudinal lines (Fig. 4).

Head relatively small, triangle-round in lateral view. In lateral view rostrum protruding downwards. Ocellus small, eye two times larger than ocellus. Distance from tip of rostrum to ocellus subequal to that between ocellus and eye.

Head shield of usual shape for the genus shape, with maximum width behind mandibular articulation. Rostrum short and rounded (Fig. 7). Posterior margin broadly rounded. Three major head pores with a very narrow connection between them (Fig. 8–9). Central pore equal to anterior and posterior one, located at the middle. PP less than 0.5 IP. Lateral head pores located in small depressions about 0.8 IP distance from midline, at level between anterior and central major head pores.

Labrum of moderate size (Fig. 10–11). Distal labral plate without setulation. Labral keel of moderate width, with a blunt apex of varied shape. Anterior margin of keel convex, frequently with notch in upper half, posterior margin almost straight. No special lateral projections on labrum and no special folds surrounding its base.

Thorax and abdomen short, subequal in length. Dorsal surface of abdominal segments not saddle-shaped. No abdominal projections.

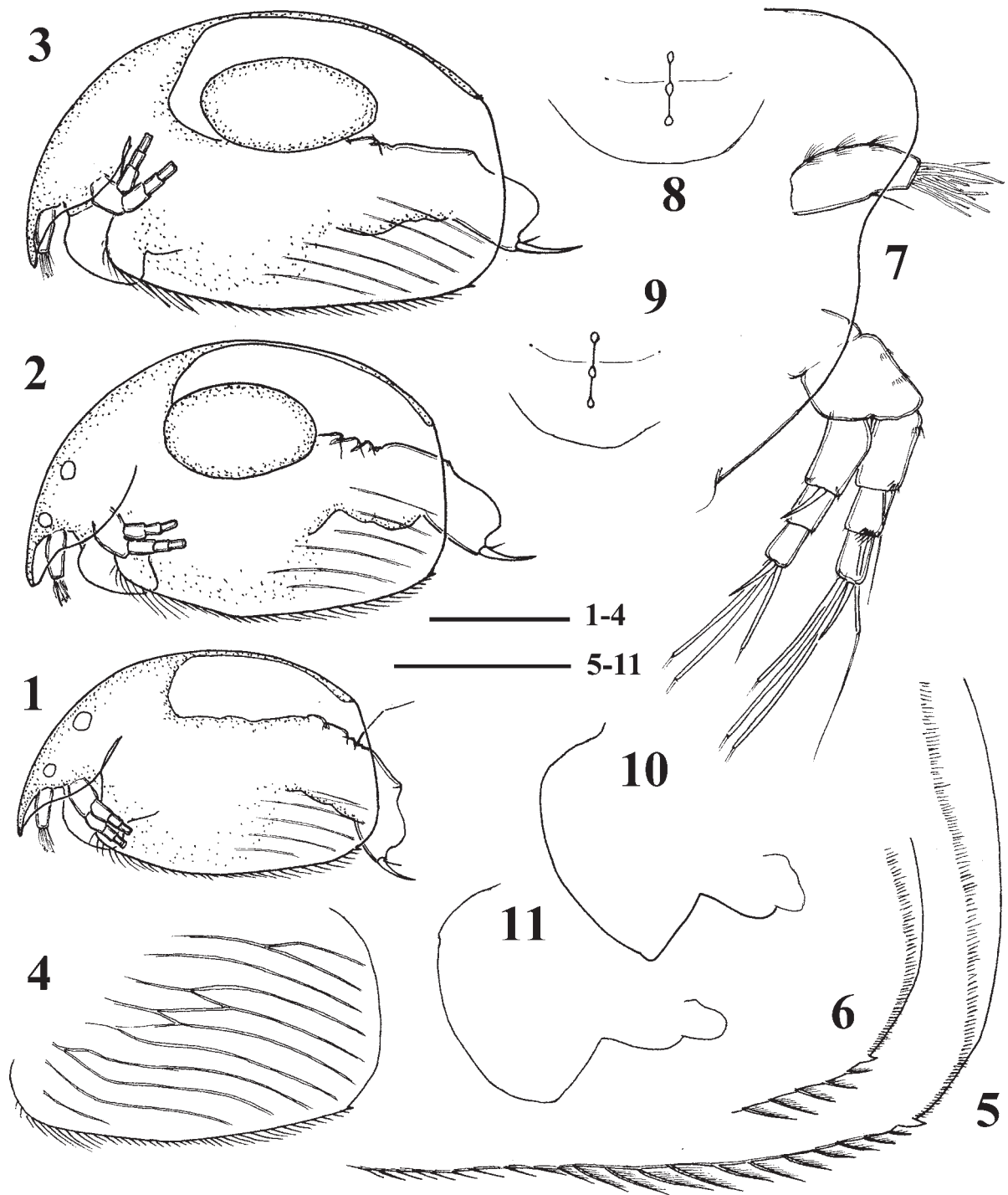


Fig. 1-11. *Alona monacantha* Sars, 1901 from Ipiranga, Brazil: 1 — juvenile female of instar II; 2-11 — adult parthenogenetic female: 2-3 — lateral view, 4 — valve, 5-6 — posterior margin and posteroventral angle of left and right valves of the same specimen, 7 — rostrum, antennulule and antenna; 8-9 — head pores; 10-11 — labrum. Scale bars denote 0.1 mm for 1-4, and 0.05 mm for 5-11.

Рис. 1-11. *Alona monacantha* Sars, 1901 из Ипиранги, Бразилия: 1 — ювенильная самка второго возраста; 2-11 — взрослая парthenогенетическая самка: 2-3 — вид сбоку, 4 — створка, 5-6 — задний край и заднее-нижний угол левой и правой створок одной особи, 7 — рoстрoм, антеннула и антенна; 8-9 — головные поры; 10-11 — лябрум. Масштаб 0,1 мм для 1-4, 0,05 мм для 5-11.

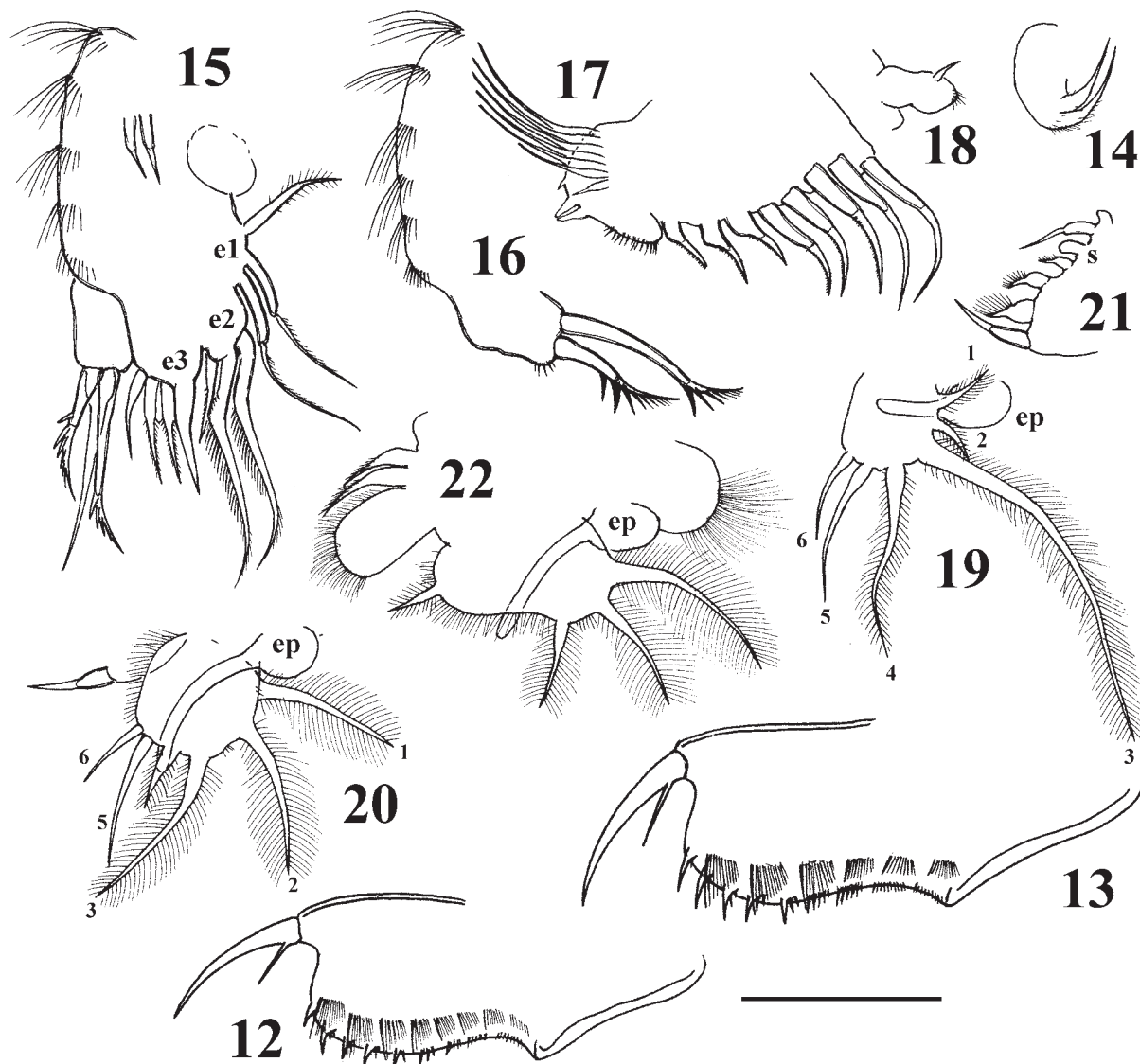


Fig.12–22. *Alona monacantha* Sars, 1901 from Ipiranga, Brazil, parthenogenic female: 12–13 — postabdomen, 14 — maxillule, 15–16 — limb I and its IDL, 17–18 — limb II and its exopodite, 19 — exopodite of limb III, 20–21 — exopodite and inner portion of limb IV; 22 — limb V. Scale bars denotes 0.05 mm.

Рис.12–22. *Alona monacantha* Sars, 1901 из Ипиранги, Бразилия, партеногенетическая самка: 12–13 — постабдомен, 14 — максиллула, 15–16 — нога I и ее внутренняя дистальная доля, 17–18 — нога II и ее экзоподит, 19 — экзоподит ноги III, 20–21 — экзоподит и внутренняя часть ноги IV; 22 — нога V. Масштаб 0,05 мм.

Postabdomen of moderate width, with convex dorsal margin, length about 2.3–2.4 height. Ventral margin straight or weakly convex. Base of claws separated from distal margin by a clear incision. Dorsal margin with distal part about 1.2 times longer than preanal one, with postanal portion slightly longer than anal one. Preanal margin almost straight. Preanal angle well expressed, postanal angle not defined. Distal margin almost straight, distal angle broadly rounded. Postanal margin with 5–6 well-developed, sharp, slender denticles, size of denticle increasing distally. Anal margin with 4–5 groups of marginal setules. 6–7 broad lateral fascicles of long setules, posteriormost setae of each fascicle longest, longer than marginal denticles. Postabdominal claw of moderate length, slightly shorter than preanal portion of postabdomen. Basal spine long and slender, about 0.40–0.45 of the claw length.

Antennule of moderate size, not reaching the tip of rostrum, with 3 transverse rows of short setules on anterior face (Fig. 7). Antennular seta thin, about 1/3 of antennule length, arising at 2/3 distance from the base. Nine short, thin, similarly sized aesthetascs, subequal in length, longest about 1/2 length of antennule. All aesthetascs projecting beyond anterior margin of the head shield.

Antenna relatively short (Fig. 7). Basal segment robust, with short seta between branches, branches relatively short, all segments cylindrical, with short setules around distal margin. Proximal segments of branches 1.5 times longer than middle and distal segments. Seta arising from proximal segment of endopod thin, reaching end of endopod. Seta arising from middle segment of endopod of similar in size to terminal setae. Spine on basal segment of exopod longer than middle

segment. Spines on distal segments longer than distal segments.

Mandible of morphology usual for genus. Maxillule (Fig. 14) with two partially setulated, tapered processes recurved toward its base.

Trunk limbs: five pairs.

Trunk limb I of moderate size (Fig. 15). Epipodite oval, without finger-like projection. ODL with one seta. IDL (Fig. 16) with only two setae, 1st IDL setae absent, both 2nd and 3rd IDL setae 2-segmented, both with strong denticles in distal part, 2nd seta about 2/3 length of 3rd seta.

Endite 3 with four setae subequal in length. Endite 2 with two long distally setulated setae longer than ODL seta, and a shorter seta near their base. Endite 1 with two 2-segmented setae, both setulated in distal part, and a flat seta shifted to the limb base. Five rows of thin long setules on ventral face of limb. Two ejector hooks subequal in length.

Trunk limb II subtriangular (Fig. 17). Exopodite elongated, of irregular shape, setulated distally, with one slender seta 1/3 length of exopodite itself (Fig. 18). Eight scraping spines increasing in length distally, with the exception of scraper 6, which is shorter than scraper 7. Distal armature of gnathobase with three elements. Filter plate II with seven setae, the distalmost member conspicuously shorter than others.

Trunk limb III: epipodite oval, with finger-like projection of same length as epipodite itself. Exopodite (Fig. 19) subquadrangular, with six setae, seta 3 longest, setae 4 and 5 of about 1/2 and 1/3 length of seta 3, respectively, other setae short. Distal endite with 3 setae, two distalmost members slender, sharp, without visible setules in distal part; proximally seta flattened, bilaterally armed with long setules. Basal endite with 4 setae. We were unable to study gnathobase and soft setae in detail. Filter plate III with seven setae.

Trunk limb IV: Pre-epipodite setulated; epipodite oval, with finger-like projection two times longer than exopodite itself (Fig. 20). Exopodite subquadrangular, with six setae. Seta 3 being longest, setae 1, 2 and 5 about 2/3 of seta 3, setae 4 and 6 of less than half length of seta 3. Setae 1–4 pennate, setae 5–6 without visible denticles. Inner portion of limb IV with four setae and sensillum (Fig. 21). Scraping seta slender, without visible denticles, three flaming-torch seta decreasing in size proximally. Three soft setae increasing in size proximally. Gnathobase with one short 2-segmented seta, and a small hillock distally. Filter plate with five setae.

Trunk limb V: pre-epipodite setulated; epipodite oval, with finger-like projection two times longer than epipodite itself (Fig. 22). Exopodite not divided into two lobes, with four setae, size of setae decreasing basally. Inner limb portion as elongated rounded lobe, with setulated inner margin. At inner face, two short setae with wide bases, one slightly longer than other. No filter plate found.

Ephippial female and male unknown.

Size: length of the only instar II juvenile female that was studied was 0.28 mm, height 0.16 mm. In the adult females studied, length ranged from 0.31 to 0.42 mm, height from 0.18 to 0.24 mm. According to Sars [1901], maximum length of female was 0.45 mm.

VARIABILITY: Size of denticles on posteroventral corner of valves varies from specimen to specimen, size of denticle on left and right valve of the same specimen frequently differs significantly. Shape of labral keel varies considerably, specimens with a notch on anterior margin of keel and without one are present in the specimens studied, apex of keel varies from broad to narrow. Since only a small number of specimens was studied, greater degree of variability possibly will be found in the future.

Discussion

Alona monacantha seems to be a species of the *rectangula*-group, sharing numerous similarities with *A. rectangula*. The parthenogenic female body shape and size, shape and armament of female postabdomen, and shape and placement of head pores are almost the same in these two species [see Frey, 1988; Alonso, 1996]. Both species have an IDL with a completely reduced 1st seta; shape and armament of two other setae is very similar in these two species, and there are no significant differences in morphology of the endites of limb I. Exopodites III of both species have only six setae, while most species of the genus *Alona*, including the type species, *A. quadrangularis*, have seven setae. If not for the distinctive denticles of *A. monacantha*, these species can be easily confused. Other differences between *A. rectangula* and *A. monacantha* include different length of basal spine and different morphology of labrum; specimens with a notch on the anterior margin of the labral keel were never recorded for *A. rectangula*.

Comparison between morphology of the type population and other recorded populations of *A. monacantha* reveals little. Outer morphology and postabdomens of specimens from Venezuela [Brehm, 1957], Florida [Megard, 1967], and Tchad [Rey & Saint-Jean, 1968] does not differ from that of the type population. Specimens recorded from Malaysia [Idris & Fernando, 1981] also don't differ from the type population in these characters and also in morphology and variability of the labrum and major head pores. The number of denticles on valves in Malaysian population varies from 1 to 3.

Since there are no significant differences in morphology between this description of *A. monacantha* and all above-mentioned reports of this animal from America, at present we should treat all of them as belonging to *A. monacantha* s. str. distributed in America from Florida to Brasil. But the identity of African and Asian population with *A. monacantha* s. str. is doubtful. It was shown that several seemingly cosmopolitan or pantropical "species" of *Alona*, like *A. cambouei* and *A. pulchella* [see Sinev, 2001, 2002], *A. verrucosa* [Dumont et al., 1984], *A. affinis* [Sinev, 1998] are really complexes of species with different species present in Old and New World. During the 20th century *A. monacantha* was the only recognised small-sized tropical species of *Alona* with denticles on the posteroventral corner of valves, so it's quite possible that in the 20th century authors automatically identified any such form as *A. monacantha*. The taxonomic status of *A. acuticostata* and *A. hardingi* should be reexamined.

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