

Alona pectinata (Crustacea: Anomopoda; Chydoridae), a new freshwater cladoceran from Southeast Mexico

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Abstract: A new species of the chydorid cladoceran genus *Alona* is described herein from parthenogenetic females. The material was collected from several freshwater lagoons and pools in the southern portion of the Yucatan Peninsula, Mexico at an altitude less than 100m above sea level. The new species can be distinguished from other species of *Alona* by the combination of several features: a well-developed armature of the antennae, postabdomen, and postabdominal claw, the outer distal lobe of the first thoracic limb bears two pecten-like setae, and the exopod of thoracic limb III has only five setae. This new taxon is related to other species of *Alona* described from South America and the Old continent.

Key words: Cladocera, Anomopoda, Mexico, taxonomy, Chydoridae

The genus *Biapertura* was proposed by Smirnov (1971) to contain alonid branchiopods with two main pores connected on the headshield. Formerly, most of the taxa included in this genus were assigned to *Alona*, which is featured by having three pores connected on the headshield. Actually, it seems that the genus *Biapertura* is not valid because the number of pores has been recently described as a variable character (Smirnov pers. comm.). Hence, we follow here the designation for *Alona*, *sensu* Alonso (1996). According to the recent review of the Mexican cladocerans made by Elías-Gutiérrez *et al.* (1999), previous records of *Alona* with two headpores in Mexico include only two species: *A. affinis* (Leydig, 1860) from the states of Aguascalientes and Mexico, and *A. karua* (King, 1853) recorded in Nuevo León, San Luis Potosí, Campeche and Quintana Roo. It seems that the genus has a widespread distribution from high to low altitudes above sea level. In this paper we describe a new species of *Alona* collected in the Calakmul Biosphere

Reserve, Campeche, Mexico. It seems to be a form closely related to the *verrucosa* complex.

MATERIAL AND METHODS

Samples were collected from several karstic water bodies with a 50 µm plankton net attached to a handle and fixed with a 4% formaldehyde solution. All the material was collected in March 20, 1997. The specimens were sorted from the entire sample and analyzed under a compound microscope, drawings were made with the aid of a camera lucida. This material was compared with detailed descriptions and illustrations from several sources.

Alona pectinata sp. nov. (Figs 1-2)

Holotype: Vial with adult parthenogenetic female preserved in 70% ethanol with a drop of glycerin, access number USNM-243620, deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.

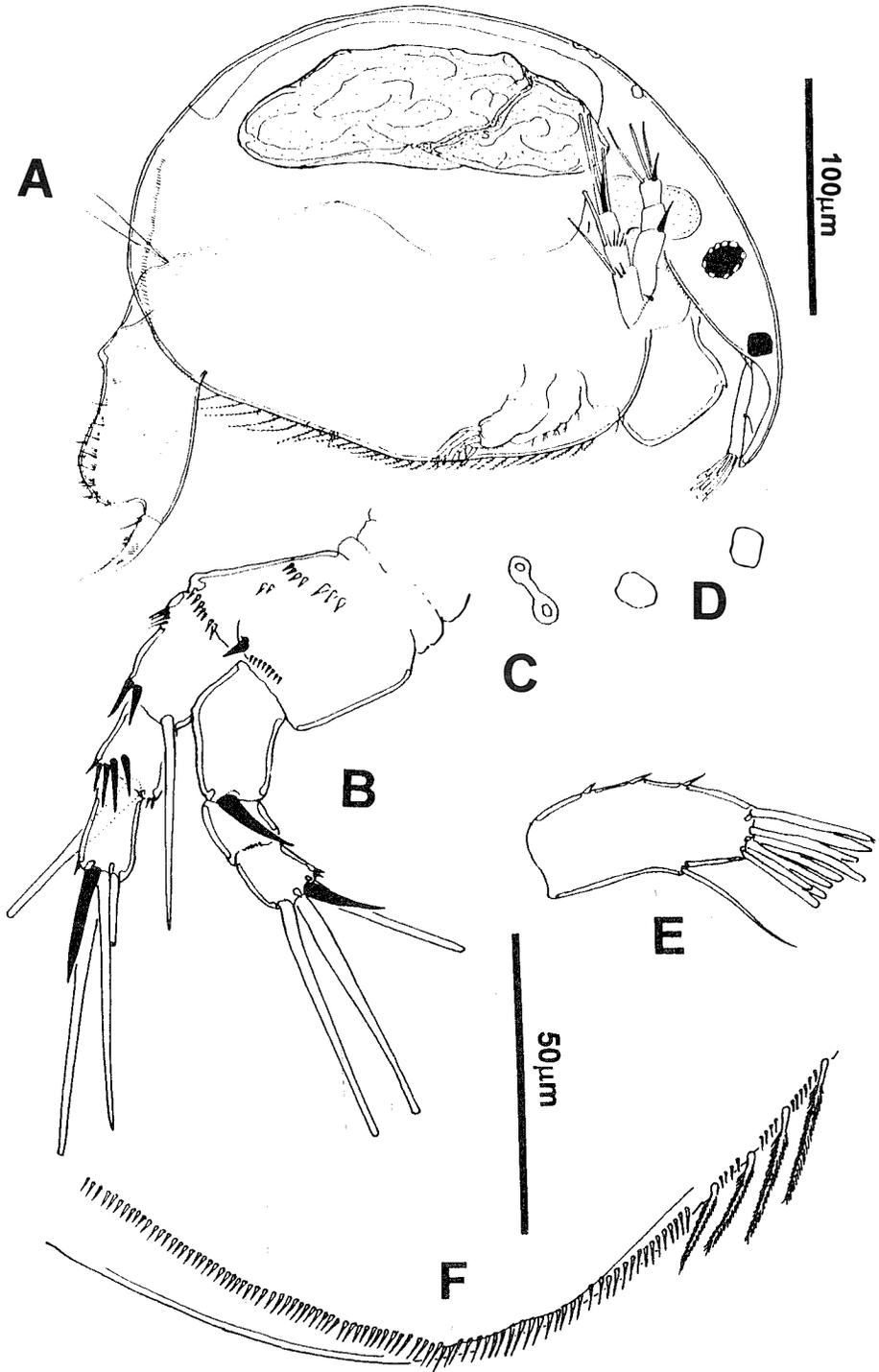


Fig. 1. *Alona pectinata* sp. nov., parthenogenetic female. A. Habitus, lateral view; B. Antenna II; C. Cephalic pores; D. lateral pores; E. Antenna I; F. posterior margin of valvae.

Paratypes: three parthenogenetic females preserved in 70% ethanol with a drop of glycerin, access number USNM-243621, deposited at the NMNH, Smithsonian Institution. Four parthenogenetic females, preserved in ethanol with a drop of glycerin, deposited in the Reference Collection at the National Autonomous University of Mexico (UNAM), Campus Iztacala; four parthenogenetic females in 70% ethanol with a drop of glycerin, access number ECO-CHZ-285, deposited in the Zooplankton Collection of El Colegio de la Frontera Sur (ECO-SUR), Unidad Chetumal, Mexico.

Additional material and original samples are held at El Colegio de la Frontera Sur.

Etymology: The specific name, from the Latin term *pecten*, comb or comb-like. It was derivated as a female adjective, as is the generic name. It makes reference to the characteristic comb-like structures on the distal endites of trunklimb I.

Diagnosis: General outline of mature parthenogenetic female more or less rounded, posterior margin curved. Shell with small dots, vesicles or furrows absent. Two major head pores; lateral pores located in a cuticular depression, located more anterior than main pores. Compound eye surrounded by several hyaline lenses, ocellus slightly smaller than eye. Sensory papilla of antennule with nine aesthetascs, one of them larger, seven more subequal and one smaller. Antenna with a fan of 4-5 long needle-like setae, arising distally from second proximal exopodial segment, with two additional needle-like setae on first proximal segment. Labral keel conspicuous and rounded, with a small tooth-like projection, a character constant in all members of this taxon. Inner distal lobe of exopod I with two pectinated seta. Postabdomen with distal side rounded; postanal and preanal regions nearly equal, distal part with a deep depression or notch, setting off a peduncle for the claw; 7-9 marginal denticules, the three or four more proximal to anal groove preceded by one small spine. Anal groove with two groups of smaller denticules. Lateral surface of postabdomen with 9-10 spines, the eight proximalmost

spines grouped, with an additional set of 4-5 small spinules. Ventral margin smooth, slightly curved. Postabdominal claw relatively large (about three quarters of the postanal length), provided with a short (about 3.5 times shorter than claw), slender, basal spine; preceded by two small setules arising also from claw.

Full description of parthenogenetic female: Dimensions: 0.299 mm (0.314-0.274 mm) length; 0.200 mm (0.225-0.176 mm) height. Shape and shell: Outline of mature parthenogenetic female somewhat variable, but generally ovoid (Length/Width: 1.5) (Fig. 1A), ventral margin slightly convex to almost straight; posterior margin rounded forming a continuous slope dorsally; dorsal margin convex, curved smoothly downward near rostral tip. Posterior-dorsal corner widely curved. Mean of 29-30 ventral setae in mature females increasing gradually in size posteriorly (Fig. 1F). The last two or three setae are smaller than the previous ones. The distal part of the valve, as far as its upcurving section, is with a continuous series of relatively long, fine setules, arising slightly submarginally but extending well beyond margin of posterior-ventral angle, then becoming submarginal suddenly and continuing dorsally as a distinct row nearly straight, not parallel to posterior margin. Essentially no pigmented organisms.

Head shield: Not keeled, but laterally flattened (Fig. 1A), and extending upwards. Two major head pores, close together, connected by a distinct chitinous channel, located about two times the IP (interpore) distance from posterior margin (Fig. 1C). Lateral pores located on either side, in noticeable depression, anterior to the main pores (Fig. 1D). Compound eye surrounded by several hyaline lenses and ocellus slightly smaller:

Antennules: Elongated, narrowing distally; end reaching tip of rostrum with aesthetascs surpassing the length of it. Set of nine apical aesthetascs, one of them longer and one smaller than the rest; longest about 2/3 length of antennule, shortest one about half as long. Antennular seta inserted at about 1/3 from tip of antennule (Fig. 1E).

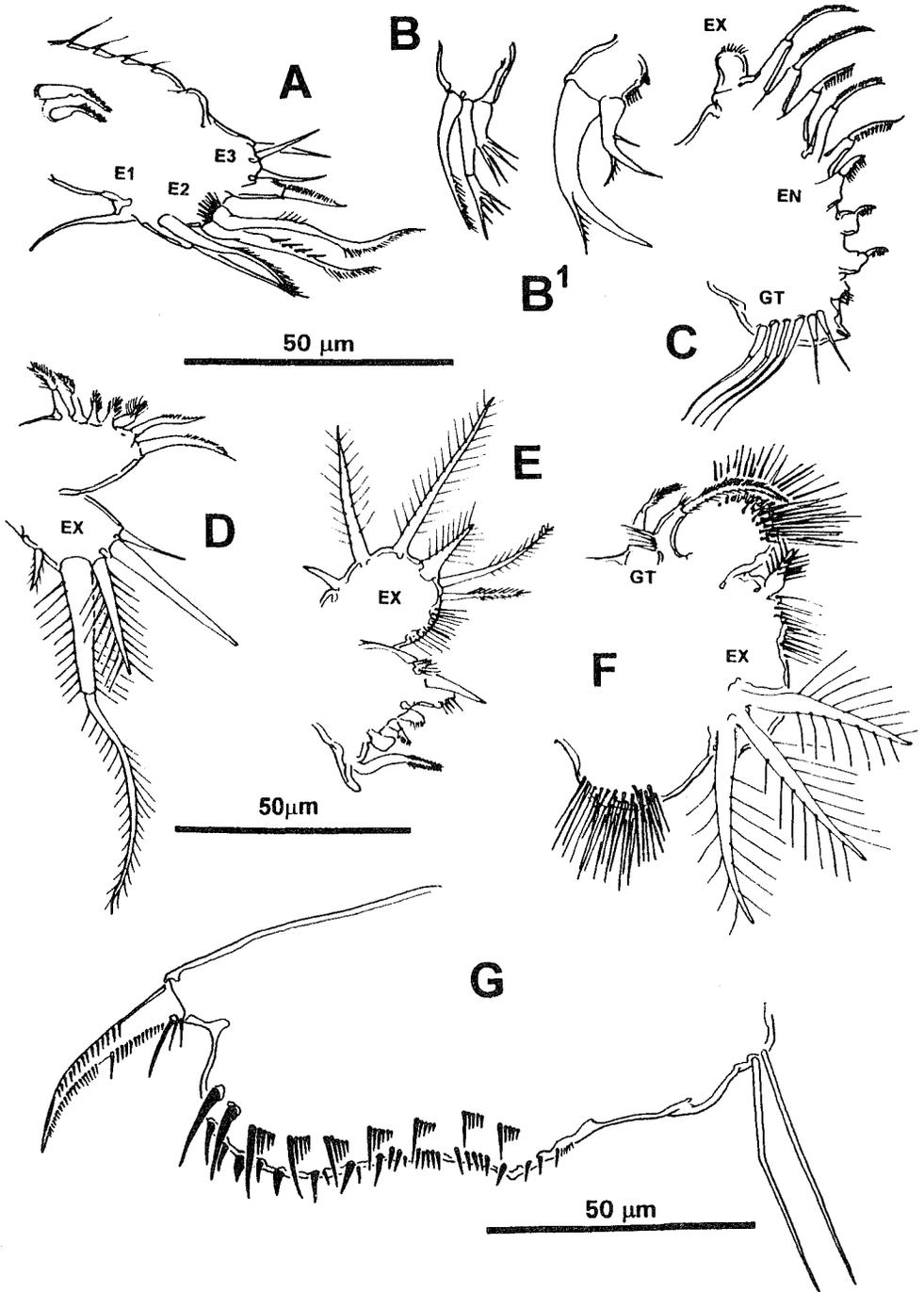


Fig. 2. *Alona pectinata* sp. nov., parthenogenetic female. A. First thoracic limb; B. distal lobes, first thoracic limb; B1. Distal lobes, first thoracic limb of *B. verrucosa* (Alonso, 1996), a closely related species. C. Second thoracic limb; D. third thoracic limb; E. fourth thoracic limb; F. fifth thoracic limb; G. postabdomen. EN: endopodite; EX: exopodite; GT: gnathopodite; E1-3: endites 1-3.

Antenna: Armature as 0(1), 0, 3(1)/ 1, 1, 3(1) (Fig. 1B). External face of coxa with groups of spines and spinules arranged in rows. With strong, short coxal distal spine between endo- and exopod. Spines on exopod large and stout, slightly curved, longer than middle segment of ramus; terminal spine of endopod longer than those on exopod. Each two proximal exopodal segments bearing distally a fan of 2 and 4 to five needle-like setae, respectively. Distal edge of each antennal segment with rows of minute setae.

Labrum and mouth parts: Labral keel conspicuous, rounded, anterior margin with a characteristic small tooth near base.

Trunklimb I (Figs. 2A, B): Ventral edge with four rows of hair-like setae, endite 1 with two thin setulae, setulated on one side of distal half. Endite 2 with two long, stout setae, shortest one with row of strong setules along second third; distal third with thin setulae on opposite margin. The longer one with a similar pattern of setulae, but those on the middle third are thinner. Endite 3 with four setae, two stronger and longer and two smaller. IDL (endite 4) with two setae, forming a pecten-like structure on distal segment. ODL (exopod) with a single, setulated seta.

Trunklimb II (Fig. 2C): Exopod reduced, with a group of tiny setules on distal end. Endopod with eight bisegmented, scraping spines, 1-5 increasing in length with a characteristic pecten-like structure; the sixth shorter but stronger and the outermost two thinner and unilaterally setulated. Gnathobase with a filter comb with six setae, the two closest to gnathobase much shorter than the others. Between gnathobase and first scraper there is a small lobe with tiny hairs

Trunklimb III (Fig. 2D): Exopod with five setae of different lengths, distalmost is longest, bisegmented, and setulated on both sides, the third one is stronger built and second in length; innermost is smaller. Endite with five setae, the two distalmost longer and unilaterally setulated on second half and the two innermost bisegmented, bilaterally setulated. The three in the middle are stouter and shorter, tip densely setulated.

Trunklimb IV (Fig. 2E): Exopod with six setae, two are longer and stouter than the rest; distalmost shortest, naked. Gnathobase reduced, composed by a densely setulated seta and a finger-like lodge preceded by one long, densely setulated seta; after this there are one naked lobe, two setae and a strong, pectinated lobe-like seta and a claw-like strong seta.

Trunklimb V (Fig. 2F): Exopod with three well-developed feathered setae. Endopod with a short distal feathered seta, followed by a densely setulated flap and two short setae.

Postabdomen (Fig. 2G): Relatively short and rounded on distal dorsal side. Postanal region long, convex, with a depression or notch at distal part, setting off a peduncle for the claw. Preanal angle conspicuous. Most commonly with nine or ten clusters of marginal denticles, of which the two distalmost members are sole spinules. Anal-groove armed with two rows of setae. Marginal spinules 7-9, with the 2-3 most proximal members associated with a small spinule.

Postabdominal claw (Fig. 2G): Short, curved, with a short (about 3.5 times shorter than claw), slender, slightly curved basal spine, sharply pointed, tapering distally. Two small spinules arise from claw, proximal to its base. Inner row of spinules consist of two groups, proximal with 7-11 larger structures and distal with 4-8 much smaller spinules; spines on both groups sharp. Margin of claw armed with two groups of spinules, proximal increasing in length ending with a larger spine. Distal group decreasing gradually in size, with 17-21 spinules.

DISCUSSION

Although the number of head pores is a character considered as a major feature with a phylogenetic significance for all the Chydoridae (Olesen 1996), it seems that this character is variable at least in some Aloninae (Smirnov pers. comm.). Therefore, according with this new information, the genus *Biapertura* proposed by Smirnov (1971) is not

valid. At the species level, the *verrucosa* group of species is quite complex, because it includes many closely related taxa from the Old and New World. According with the new ideas proposed by several authors (*v. gr.* Frey 1995), most of the chydorid fauna contains closely related species with restricted distributional patterns as was demonstrated for several taxa (Frey 1980, 1988). In Mexico, it is suggested that the occurrence of a wide diversity of true microhabitats with extremely peculiar environmental conditions, derived from the complex physiography and hydrography, favoured speciation of several cladocerans such as *Macrothrix mexicanus* Ciroso-Pérez, Silva-Briano & Elías-Gutiérrez, 1995, *M. smirnovi* Ciroso-Pérez & Elías-Gutiérrez, 1997, and *Spinalona anophthalma* Ciroso-Pérez & Elías-Gutiérrez, 1997. This is true for other freshwater zooplankters such as the copepods *Microdiaptomus cokeri* (Osorio-Tafall, 1941), *Mastigodiaptomus montezumae* Brehm, 1955, *Leptodiaptomus mexicanus* (Marsh, 1929), and cyclopoids of the genera *Diacyclops* and *Mesocyclops* from Yucatan (Fiers *et al.* 1996).

Alona verrucosa Sars was originally described from dry mud collected near São Paulo, Brazil, the specific name was decided on basis of the heavy vesicle-like structures on the valvae (Sars 1901). After that the taxon has been recorded in other regions such as Asia, Africa and Europe (see Smirnov 1971). If we consider the statement of Dumont & Segers (1996) showing a strong geographic gradient of cladoceran species, these records should be revised to clarify their taxonomic status under a more detailed morphological approach. Unfortunately, most of the reference material is not available. The new information generated

by the upgraded analysis of cladocerans, which includes examination of all thoracic limbs and not only the general appearance of the valves and the postabdomen, has yielded evidence to weaken the idea of cosmopolitanism in anomopod branchiopods (Frey 1980, 1988, Ciroso & Elías-Gutiérrez 1997).

The new species status of *Alona pectinata* is supported by the unique combination of the following morphological features:

1. Two pectinate setae and one unisetulated seta on IDL instead of two strong claw-like setae with a setulated projection. This character seems to be shared by the *A. verrucosa*, *sensu* Alonso (1996), and *A. verrucosa sensu stricto*. A similar feature was used by Frey (1988) as one of the important characters to differentiate *A. weinecki*, a subarctic form, from *A. rectangularis*, restricted to Eurasia.
2. Valves with no-vesicle-like structures, it is entirely smooth, with no longitudinal lines on it.
3. Ventral setae not forming three groups as in other species. Instead of that there is only one group of setae gradually increasing in size from the anterior margin. The last two or three setae decreasing in size, also gradually.
4. Two small spines on the first segment of the antennal endopod and a fan of 4-5 spines on its second segment.
5. Two groups of 5-6 spines on the anal region and several scattered spines anterior to the preanal angle.
6. Five unequal setae on the third leg exopod, instead of six.

This animal is possibly part of the community associated with the peryphyton, with scrapping habits as it is suggested by the evident specializations of limbs 1-3.

It was no possible to find males and ephyphial females, because the conditions in Yucatan Peninsula are quite stable, with a mild winter, and permanent water sources, with a moderate to high precipitation rates most of the year.

TABLE 1

Main physical and chemical conditions of the Calakmul lagoon when Alona pectinata was collected

Depth	.....	.0.87 m.
Secchi transparency:	.....	total.
Dissolved Oxygen	.....	.11.7 mg/l
Alkalinity	.....	.15.5 mg/l CaCO ₃
Temp. water	.....	.26.4 °C
Temp.	.....	.29 °C

Type locality : A summary of the main physico-chemical conditions in the habitat of this cladoceran at the moment of the collections is given in Table I. The lagoon is located inside of the Calakmul Biosphere Reserve, Campeche, Mexico, near the Calakmul archaeological site. Coordinates of the sampling site are 18° 07.39' N; 89° 18.91' W at 180 m. above sea level. The system never dries, it is endorreic filled by the water table, depth: 0.87 m.

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RESUMEN

A partir de hembras partenogenéticas, se describe una nueva especie de *Alona*, un cladóceros Chydoridae. El material fue recolectado en varios cuerpos de agua continentales del sur de la Península de Yucatán, México, a una altitud de menos de 100 m por arriba del nivel medio del mar. La nueva especie puede ser distinguida de otras especies de *Alona* por la combinación de varias características: la armadura de la antena, postabdomen y garra postabdominal se encuentran bien desarrolladas, el lóbulo distal externo del primer apéndice torácico posee dos setas en forma de peine que son características de esta especie; el exopodito del tercer apéndice torácico presenta cinco setas. Esta nueva especie de *Alona* está relacionada con otros congéneres descritos con material de América del Sur y Europa.

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