

Place of a Central American bromeliad-inhabiting cladoceran
Alona bromelicola Smirnov, 1988 within the genus
(Branchiopoda: Anomopoda: Chydoridae)

Положение центральноамериканского ветвистоусого рака
Alona bromelicola Smirnov, 1988, в системе рода
(Branchiopoda: Anomopoda: Chydoridae)

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КЛЮЧЕВЫЕ СЛОВА: ветвистоусые раки, систематика, морфология.

ABSTRACT: The detailed morphology of the cladoceran *Alona bromelicola* Smirnov, 1988, is described. It is the only species of the genus *Alona* Baird, 1843 inhabiting the waters accumulated within the funnels of leaves of epiphyte bromeliad plants of tropical forests. Close relationship between *A. bromelicola* and the recently revised *pulchella*-group of species was revealed. Despite the unique morphological characters, developed as adaptations to the unique conditions, *A. bromelicola* undoubtedly belongs to the genus *Alona*.

РЕЗЮМЕ: Детально исследована морфология ветвистоусого рака *Alona bromelicola* Smirnov, 1988, единственного представителя рода *Alona* Baird, 1843, обитающего в воде, скапливающейся в розетках листьев эпифитных растений семейства бромелиевые тропических лесов. Выявлены родственные связи между *A. bromelicola* и недавно ревизованной группой видов *pulchella*. Несмотря на уникальные черты строения, вызванные адаптацией к уникальным для рода условиям обитания, принадлежность *Alona bromelicola* Smirnov, 1988, к роду *Alona* не вызывает сомнения.

Introduction

Alona bromelicola Smirnov, 1988 is the only species of genus *Alona* Baird, 1843 that inhabits the water accumulated within the funnels of leaves of epiphyte bromeliad plants of tropical forests. It was reported only from Nicaragua [Smirnov, 1988, 1992]. As was noted by Smirnov [1988], *A. bromelicola* possesses several outstanding morphological features, such as a very small basal spine on the postabdominal claw and the peculiar pattern of placement of postabdominal marginal denti-

cles. However, some characters of this species, such as morphology of the trunk limbs, were not completely studied. Korovchinsky [1996] lists *A. bromelicola* among “rather well described” cladoceran species, needing further study using modern methods of investigation. The relationships of *A. bromelicola* within the genus are obscure; Smirnov [1988] suggested that it is related to *A. karelica*, the only other species with a very small basal spine, but no additional arguments to support this opinion were given.

As Sinev & Kotov [2000] suggested, the investigation of incompletely studied marginal species of *Alona* having unique features can be very valuable to the taxonomy of genus. The aim of the present study is investigation of the detailed morphology of *A. bromelicola* to determine its place within the genus.

Material and Methods

The studied material includes:

Holotype, parthenogenetic female, from Nicaragua, neighborhood of Managua, Mt Mombacho, water accumulated in an epiphytic bromeliad, on slide in Canada Balsam, NNS slide 3448.

Allotype. Adult male on slide in Canada Balsam, NNS slide 3374.

Paratypes: 6 parthenogenetic females, on slide in Canada Balsam, NNS slides 3495, 3496, 3497, 3500, 3501, 3504; 3 adult males on slide in Canada Balsam, NNS slides 3356, 3446, 3447.

Other material: 9 parthenogenetic females, 7 juvenile females of instar II, 1 ephippium, many exuviae and valves from type location, sample NNS-2000-004; 47 parthenogenetic females, 12 juvenile females of instar II, 1 juvenile females of instar I from Nicaragua, 9 km N of the city of Matagalpa, slope near Santa Maria de Ostuma, water from epiphytic bromeliads, sample NNS-2000-003.

Animals were selected from samples under a binocular stereoscopic microscope, placed on slides (in a drop of a glycerol-ethanol mixture) and studied under the optical microscope. Several specimens from both samples were dissected for analysis of appendages. About 15 specimens from the second sample were lyophilised, mounted on an aluminium stub, coated with gold, and examined under a scanning electron microscope (Hitachi S 405-A). All specimens were measured using an eyepiece-micrometer. Drawings were made with a camera lucida.

ABBREVIATIONS. *In the list of material*: NNS — collection of Prof. N.N. Smirnov, now at the Zoological Museum of Moscow State 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 bromelicola Smirnov, 1988 Figs 1–36.

Smirnov, 1988: 65–72, Fig. 1–15.

DIAGNOSIS. *Female*: Body high, irregular oval, maximum height before middle of body. Length ca. 1.4–1.6 times maximum height. 45–60 setae at ventral margin significantly differentiated in size. Postero-ventral corner without denticles. Valves without sculpture.

Head shield elongated, with broadly rounded posterior margin, rostrum short and rounded. Three major head pores of equal size with a narrow connection between them, central pore at the middle. PP = 0.8–1 IP. Lateral head pores located in small depressions about 1 IP distance from midline, at level of central major head pore. Labrum of moderate size, labral keel broad, rounded, with a blunt apex, without any clusters of setules on posterior margin of keel.

Postabdomen relatively narrow, with convex ventral and concave dorsal margin, length about 2.9–3.1 height. Basis of claws separated from distal margin by clear incision. Distal margin straight, distal angle prominent. Dorsal margin with distal part about 1.5 times longer than preanal one, postanal and anal portions equal. Preanal angle well expressed, postanal angle not defined. Preanal margin straight.

Postabdomen with 5–7 well-developed, sharp, slender marginal denticles on the distal part of postanal margin and 7–9 groups of marginal setules on the proximal part of postanal margin and anal margin. 8–10 lateral fascicles of setules of moderate length, posteriormost setae of each fascicle longest, of same length with marginal denticles. Postabdominal claw of moderate length, a little longer than preanal portion of postabdomen. Basal spine less than 0.1 of the claw length.

Antennule broad, with nine very short aesthetascs. All aesthetascs projecting beyond anterior margin of the head shield. Antennal formula, setae 0-0-3/1-1-3, spines 1-0-1/0-0-1. Seta arising from basal segment of endopod thin, projecting beyond tip of distal segment. Spine on basal segment of exopod shorter than middle segment. Spines on apical segments slightly shorter than apical segments.

IDL of trunk limb I with three setae, first of these short, thin, others long, well-developed. Exopodite of trunk limb III with seven setae greatly different in length, 5th being longest. Exopodite IV with six setae. Exopodite V with four setae. Epipodites IV and V with finger-like projections longer than epipodites itself. Trunk limb VI absent.

Length: 0.4–0.51 mm.

Male: body oval, length about 1.6 times maximum height. Ventral and dorsal margin weakly concave, posterior margin strongly concave, both posteroventral and posterodorsal angles broadly rounded. Eye small, round, ocellus of irregular shape, equal in size or even larger than eye.

Postabdomen short, with parallel margins in distal part, with length about 3 times height. Ventral margin almost straight, with clear step in region of gonopores, which open ventrally near basis of claws. Distal margin almost straight, dorso-distal angle prominent. Dorsal margin straight in postanal and concave in anal part, with distal part 1.7 times longer than preanal. Preanal angle well expressed, postanal angle absent. Postabdominal claws long of same length as preanal portion of postabdomen, without basal spine.

Length 0.33–0.36 mm.

DIFFERENTIAL DIAGNOSIS. Unique shape and armament of postabdomen and peculiar body shape easily *A. bromelicola* from all other species of *Alona*. Very short basal spine on postabdominal claw is also rare within the genus and present in only one other species, *A. karelica*.

DESCRIPTION. *General*: In lateral view, body regular oval, relatively low in juvenile female of instar I (Fig. 1), irregular oval, higher in juvenile female of instar II (Fig. 2) and adults (Fig. 3, 13–16), moderately compressed laterally (Fig. 17). Maximum height before middle of body. In adults length ca. 1.4–1.6 times maximum height. Dorsal margin strongly curved, depression between head and rest of body absent. Postero-dorsal and postero-ventral angles broadly rounded. Posterior margin convex. About a hundred short setules of equal length at postero-dorsal angle, these setules not organized into groups (Fig. 6). A row of about a hundred setules along posterior margin very close to it on inner side of carapace, these setules not organized into groups. Ventral margin weakly convex to straight, with 45–60 setae (Fig. 4), anteriormost 9–13 setae long, next 17–20 setae relatively short, posteriormost 18–22 setae long (Fig. 5), with length of setae decrease posteriorly. Antero-ventral angle rounded. Carapace without any reticulation.

Head relatively small, subtriangular in lateral view. In lateral view rostrum protruding downwards. Both eye and ocellus small, eye only slightly larger than ocellus. Distance from tip of rostrum to ocellus subequal to distance between ocellus and eye.

Head shield (Fig. 7) elongated, with maximum width behind mandibular articulation, length ca. 1.8 times maximum width. Rostrum short and blunt. Posterior margin broadly rounded, a little undulate. Three major head pores with a narrow connection between them (Fig. 8, 33–34). Central pore equal to anterior and posterior one, located at the middle. PP = 1 IP. Lateral head pores located in small depressions about 1 IP distance from midline, at level of central major head pore.

Labrum of moderate size (Fig. 21, 32). Distal labral plate without setulation. Labral keel wide, rounded, with a blunt or rounded apex. Anterior margin of keel convex, posterior margin without any clusters of setules. No special lateral projections on labrum and no special folds surrounding its base.

Thorax and *abdomen* subequal in length, more elongated than in most other species of *Alona*, dorsal surface of abdominal segments not saddle-shaped. No abdominal projections.

Postabdomen relatively narrow, with convex ventral and concave dorsal margin, length about 2.9–3.1 height (Fig. 9, 18–19). Inflated basis of claws bordered from distal margin by clear incision. Distal margin straight, distal angle prominent. Dorsal margin with distal part about 1.5 times longer than preanal, postanal and anal portions equal. Preanal angle well expressed, postanal angle not defined. Preanal margin straight.

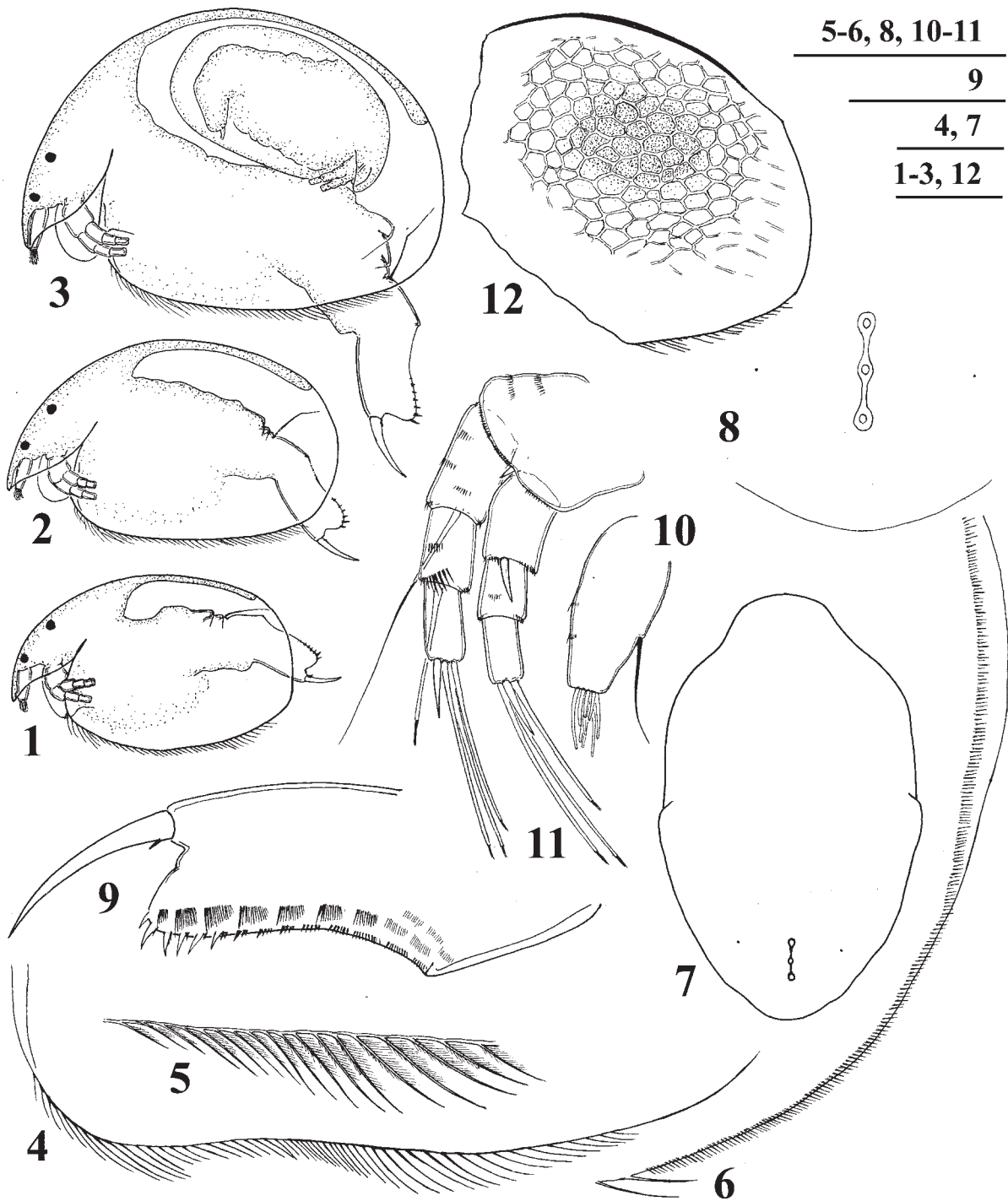


Fig. 1-12. *Alona bromelicola* Smirnov, 1988, 1-11 — from Nicaragua, 9 km N of the city of Matagalpa, slope near Santa Maria de Ostuma, water from epiphytic bromeliads: 1-2 — juvenile females of instars I and II, lateral view; 3-11 — parthenogenetic female: 3 — lateral view, 4-5 — ventral margin of valves and setae of its central part, 6 — posterior margin and posteroventral angle of valves, 7 — head shield, 8 — head pores, 9 — postabdomen, 10 — antennule, 11 — antenna; 12 — from Nicaragua, neighborhood of Managua, Mt Mombacho, water from an epiphytic bromeliad, empty ephippium, lateral view. Scale bars denote 0.1 mm for 1-3, 12 and 0.05 mm for 4-11.

Рис. 1-12. *Alona bromelicola* Smirnov, 1988, 1-11 — из Никарагуа, 9 км к северу от г. Матагальпа, склон у Санта Мария де Остума, вода из эпифитных бромелиевых: 1-2 — ювенильные самки первого и второго возраста, вид сбоку; 3-11 партогенетическая самка: 3 — вид сбоку, 4 нижний край створок и щетинки его центральной части, 6 — задне-нижний угол и задний край створок, 7 — головной щит, 8 — головные поры, 9 — постабдомен, 10 — антеннула, 11 — антенна; 12 — из Никарагуа, окрестности Манагуа, г. Момбачо, вода из эпифитных бромелиевых, пустой эфиппий, вид сбоку. Масштаб 0,1 мм для 1-3, 12, 0,05 мм для 4-11.

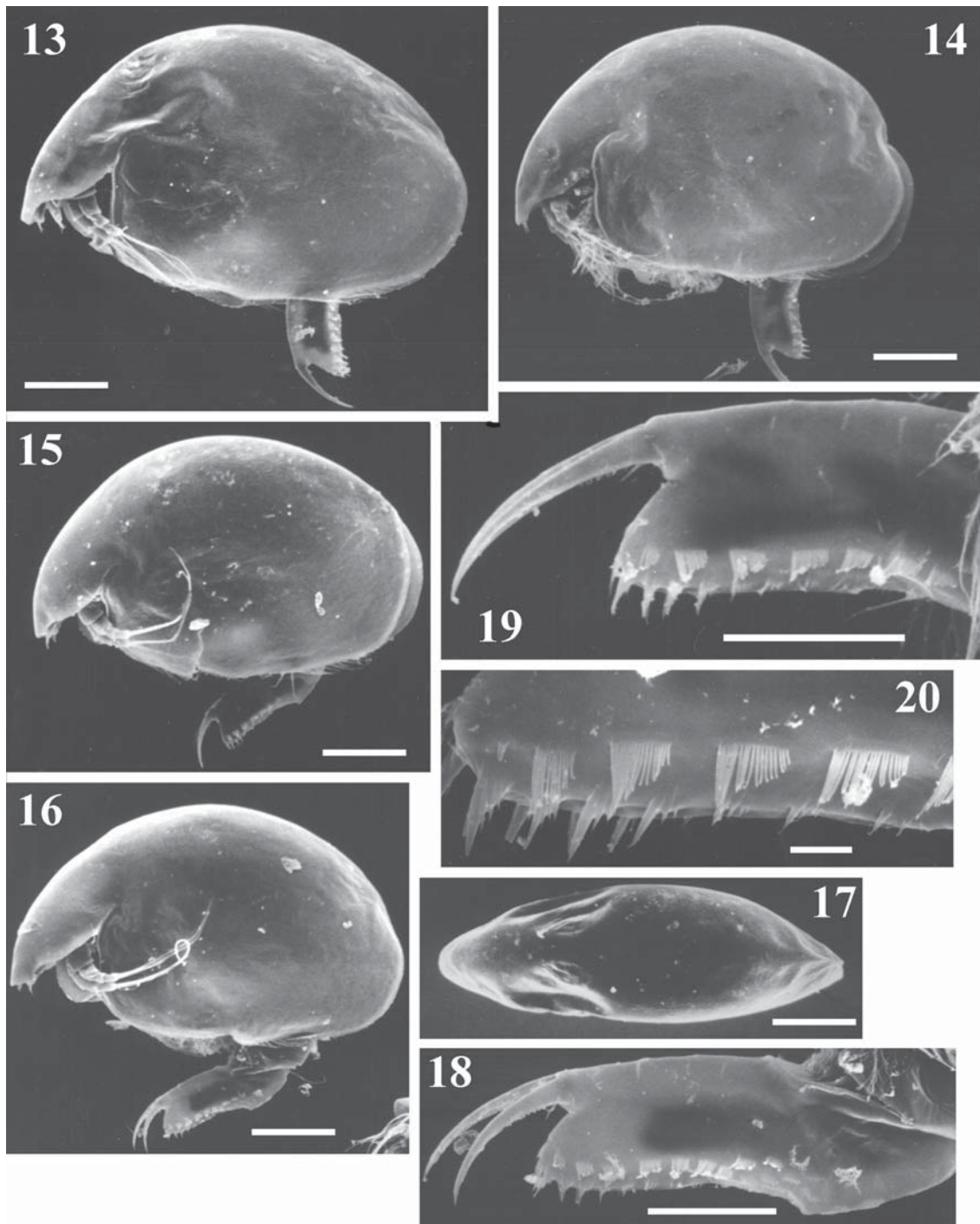


Fig. 13–20. *Alona bromelicola* Smirnov, 1988, from Nicaragua, 9 km N of the city of Matagalpa, slope near Santa Maria de Ostuma, water from epiphytic bromeliads, parthenogenetic females: 13–16 — lateral view, 17 — dorsal view, 18–19 — postabdomen, 20 — distalmost denticles of postabdomen. Scale bars denote 0.1 mm for 13–17, 0.05 mm for 18–19, and 0.01 mm for 20.

Рис. 13–20. *Alona bromelicola* Smirnov, 1988 из Никарагуа, 9 км к северу от г. Матагальпа, склон у Санта Мариа де Остума, вода из эпифитных бромелиевых, партеногенетическая самка: 13–16 — вид сбоку, 17 — вид сверху, 18–19 — постабдомен, 20 — дистальные зубцы постабдомена. Масштаб 0,1 мм для 13–17, 0,05 мм для 18–19, и 0,01 мм для 20.

Postabdomen with 5–7 well-developed, sharp, slender marginal denticles on the distal part of postanal margin and 7–9 groups of marginal setules on the proximal part of postanal margin and anal margin (Fig. 20). 8–10 lateral fascicles of setules of moderate length, posteriormost setae

of each fascicle longest, of same length with marginal denticles.

Postabdominal claw of moderate length, a little longer than preanal portion of postabdomen. Basal spine less than 0.1 of the claw length.

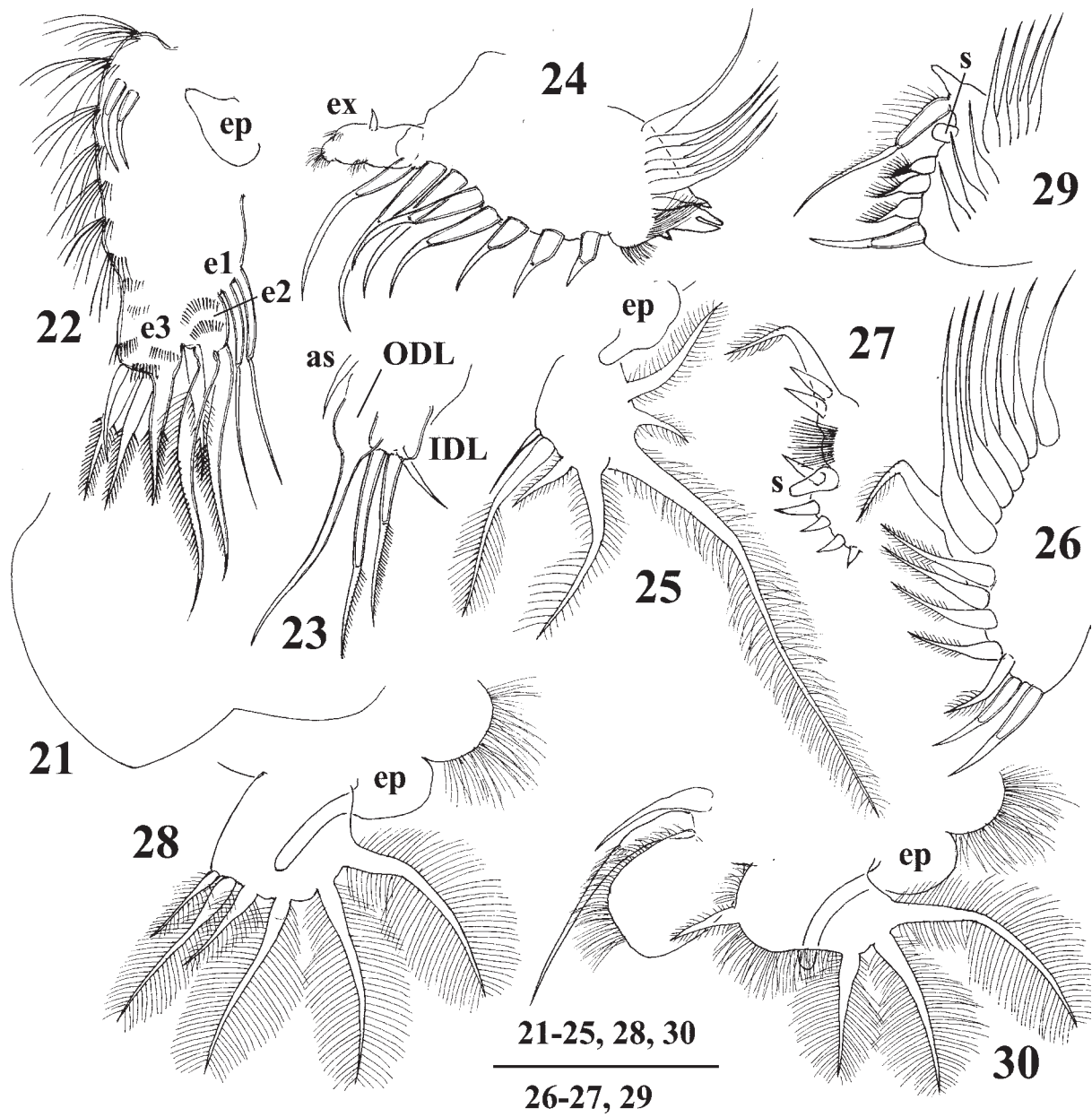


Fig. 21–30. *Alona bromelicola* Smirnov, 1988, from Nicaragua, 9 km N of the city of Matagalpa, slope near Santa Maria de Ostuma, water from epiphytic bromeliads, parthenogenetic female: 21 — labrum, 22 — limb I in inside view, 23 — IDL and ODL of limb I, 24 — limb II, 25 — exopodite of limb III, 26–27 — inner portion of limb III, outer and inner parts; 28 — exopodite of limb IV, 29 — inner portion of limb IV, 30 — limb V. Scale bars denote 0.05 mm.

Рис. 21–30. *Alona bromelicola* Smirnov, 1988 из Никарагуа, 9 км к северу от г. Матагальпа, склон у Санта Мария де Остума, вода из эпифитных бромелиевых, партеногенетическая самка: 21 — лярбрум, 22 — нога I, вид изнутри, 23 — внешняя и внутренняя дистальные доли ноги I, 24 — нога II, 25 — экзоподит ноги III, 26–27 — внутренняя часть ноги III, наружная и внутренняя часть, 28 — экзоподит ноги IV, 29 — внутренняя часть ноги IV, 30 — нога V. Масштаб 0,05 мм.

Antennule long and broad, almost reaching the tip of rostrum, with 2–3 transverse rows of very short setules at anterior face (Fig. 10, 31). Antennular sensory seta long, more than half of antennule length, arising at 2/3 distance from the base. Nine very short and thin aesthetascs, of less than 1/3 length of antennule, of similar size. All aesthetascs projecting beyond anterior margin of the head shield.

Antenna short (Fig. 11, 31–32). Antennal formula, setae 0-0-3/1-1-3, spines 1-0-1/0-0-1. Basal segment robust, with

short seta between branches, branches relatively elongated, all segments cylindrical, with short setules around distal margin. Seta arising from basal segment of endopod thin, longer than endopod. Seta arising from middle segment of endopod of similar size with apical setae. Spine on basal segment of exopod shorter than middle segment. Apical spines shorter than apical segments.

Trunk limb I of moderate size (Fig. 22–23). Epipodite oval, with short finger-like projection. Accessory seta short, thin,

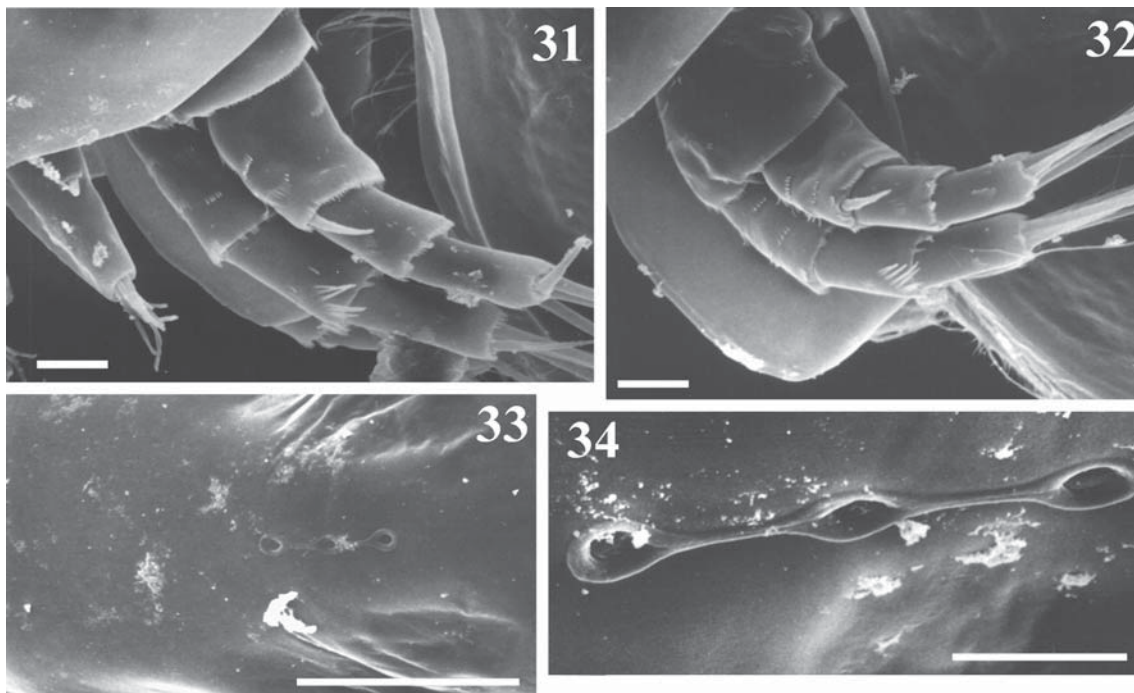


Fig. 31–34. *Alona bromelicola* Smirnov, 1988, from Nicaragua, 9 km N of the city of Matagalpa, slope near Santa Maria de Ostuma, water from epiphytic bromeliads, parthenogenetic female: 31 — antennule and antennae, 32 — plate of labrum and antennae, 33–34 — major head pores. Scale bars denote 0.05 mm for 33, 0.01 mm for 31–32, 34.

Рис. 31–34. *Alona bromelicola* Smirnov, 1988 из Никарагуа, 9 км к северу от г. Матагальпа, склон у Санта Мария де Остума, вода из эпифитных бромелиевых, партеногенетическая самка, 31 — антеннула и антенна, 32 — пластинка лярума и антенна, 33–34 — главные головные поры. Масштаб 0,05 мм для 33, 0,01 мм для 31–32, 34.

setulation on it not visible under optical microscope. ODL with one long seta, IDL with three setae, 1st IDL seta thin, pointed, of moderate length (about 1/3 of 3rd), 2nd and 3rd IDL setae 2-segmented, subequal in length, both with setules in distal part.

Endite 3 with four setae, ventralmost seta naked, much thinner and shorter than others, other setae with dense setules in distal part. On endite 2 there are three densely feathered setae, median of them equal in length to ODL seta. Endite 1 with two 2-segmented setae, both setulated in distal part. No naked setae on anterior face of limb visible under optical microscope. Six rows of thin long setules on ventral face of limb. Two ejector hooks of similar size.

Trunk limb II subtriangular (Fig. 24). Exopodite elongated, with one very short, naked seta. Inner portion of limb (“endopodite”) with eight scraping spines increasing progressively in length distally, but the closest to exopodite scraper shorter than the previous one. No setules visible on scrapers under optical microscope. A portion of gnathobase bordering “endopodite” with short setules. Distal armature of gnathobase with four elements. Filter plate II with seven setae, the posteriormost member considerably shorter, with dense cluster of long setules near its base.

Trunk limb III: epipodite oval, with short finger-like projection. Exopodite suboval (Fig. 25), with seven setae, subdivided into distal and basal groups. 5th (from exopodite) distal setae longest, 2nd and 4th three times shorter, 2nd basal seta four times shorter, other setae eight times shorter than 5th. 1st distal seta naked, 2nd with long, thick setules in distal part, other setae feathered.

Distal endite (Fig. 26) with 3 setae, two distalmost members slender, sharp, without visible setules in distal part; basalmost seta flattened, bilaterally armed with long setules

Basal endite with 4 stiff, setulated setae, increasing in size in basal direction. Gnathobase not clearly separated from basal endite. Four soft setae increasing in size basally. Distal armature of gnathobase with 4 elements (Fig. 27). The first one elongated, cylindrical sensillum, the second geniculated seta, others two spines with fused bases. A bunch of setules near them. Filter plate III with seven setae.

Trunk limb IV: Pre-epipodite ovoid, setulated; epipodite oval, with finger-like process longer than epipodite. Exopodite subquadrangular, with six setae (Fig. 28). Two lateral setae and 2nd and 4th distal setae flattened, subequal in length, 1st and 3rd distal setae two times shorter. All setae plumose. Inner portion of limb IV with four setae (Fig. 29). Distalmost seta naked, stout, 3 others flattened, subequal in size, with well-developed distal part, each armed with 8–12 long setules. 3 soft setae increasing in size basally. Gnathobase with a long 2-segmented seta and a small mound distally. Filter plate with five setae. *Trunk limb V* (Fig. 30): pre-epipodite setulated. Epipodite oval, with finger-like process longer than epipodite. Exopodite suboval, not subdivided into two lobes, lateral group with 3 long, densely setulated setae, distally only a single short seta. Inner limb portion a subquadrangular lobe, with setulated inner margin. At inner face, two densely setulated setae, distalmost very large. No filter plate was found.

Trunk limb VI absent.

Ehippial female with a higher body than parthenogenetic female. Ehippium yellow-brown in the middle, with prominent sculpture in the form of rounded cells (Fig. 12).

For males, studied material includes only five adult specimens mounted on slides in Canada balsam, so description of male is far from complete.

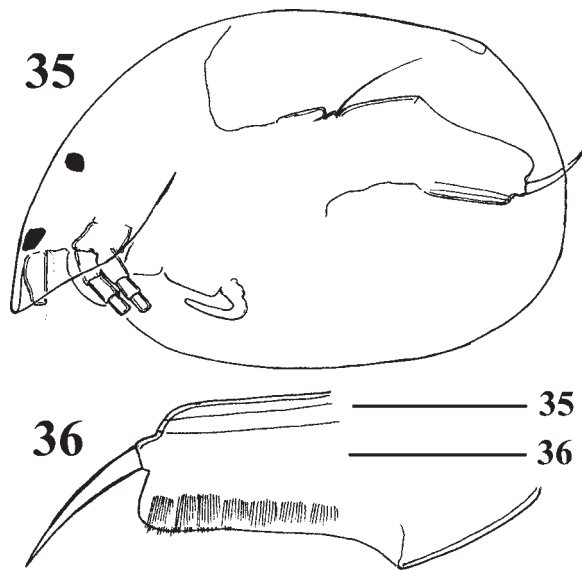


Fig. 35–36. *Alona bromelicola* Smirnov, 1988, from Nicaragua, neighborhood of Managua, Mt Mombacho, water accumulated in an epiphytic bromeliad, adult male (allotype): 35 — lateral view (setae on ventral margin of valves not shown), 36 — postabdomen. Scale bars denote 0.1 mm 35, 0.05 mm for 36.

Рис. 35–36. *Alona bromelicola* Smirnov, 1988, из Никарагуа, окрестности Манагуа, г. Момбачо, вода из эпифитных бромелиевых, самец (аллотип): 35 — вид сбоку (щетинки на нижнем крае створок не показаны), 36 — постабдомен. Масштаб 0,1 мм для 35, 0,05 мм для 36.

Body oval, similar to that of juvenile female of instar I (Fig. 35), length about 1.6 times maximum height. Ventral and dorsal margin weakly concave, posterior margin strongly concave, both posteroventral and posterodorsal angles broadly rounded. Eye small, round, ocellus of irregular shape, equal in size or even larger than eye.

Postabdomen (Fig. 36) short, with parallel margins in distal part, with length about 3 times height. Ventral margin almost straight, with clear step in region of gonopores, which open ventrally near basis of claws. Distal margin almost straight, dorso-distal angle prominent. Dorsal margin straight in postanal and concave in anal part, with distal part 1.7 times longer than preanal one. Preanal angle well expressed, postanal angle absent. Clusters of setules in place of marginal postanal denticles. Lateral fascicles of setules similar to those of female. Postabdominal claws long of same length as preanal portion of postabdomen, without basal spine.

Size: In the only studied female of first juvenile instar, length 0.26 mm, height 0.17 mm. In females of second juvenile instar, length ranging from 0.29 to 0.36 mm, height from 0.19 to 0.22 mm. In adult female, length ranging from 0.38 to 0.51 mm, height from 0.24 to 0.36 mm. Length of adult male ranging from 0.33 to 0.36 mm, height from 0.20 to 0.23 mm.

Discussion

As a species adapted to unique conditions for the genus *Alona*, *A. bromelicola* has several notable morphological features, rare or unique for the genus:

Large, rather flattened laterally antennulae with very thin and short, less than 1/3 length of antennule, aesthetascs, is unique for the genus. In other species the aesthetascs are always well-developed. Both eye and

ocellus of *A. bromelicola* are also very small in comparison with those of other species from the surface waters. Such weak development of photo- and chemo-receptors can be explained by the small size of inhabited water bodies. The space variability of conditions in such a small volume of water, contained between leaves of bromelads, should be minimal in comparison with that in littoral habitats of lakes, a common dwelling of surface species of *Alona*. Small water volumes can be more subject to ambient fluctuations of physico-chemistry than are larger lakes. But in small epiphytic water body change of conditions will affect all volume of water simultaneously, and animals have no option to migrate to more favourable conditions, so they not need well-developed chemoreceptors, which can be used by their lake counterparts for such migrations. Especially well-developed antennal setae implies that the tactile sense is more important to this species.

A very small basal spine on the claws of the female postabdomen is present only in one other species of the genus, *A. karelica* Stenroos, 1897. All other species of *Alona* have a well-developed basal spine. In contrast, several species of the genus with basal spine normally developed in the female (*A. costata* Sars, 1862, *A. setigera* Brehm 1931, *A. werestschagini* Sinev, 1999) lack it in the male, as does the male of *A. bromelicola*.

The proportions and placement of postanal marginal denticles of the postabdomen is also unusual. In the majority of *Alona*, the length of postanal denticles decreases more or less gradually, and they evenly pass into the grouped marginal setules on the anal margin. Here, in contrast, well-developed denticles are located only on the distal angle part of the postabdomen, and are proximally replaced by short setules.

A. bromelicola shares a number of characteristic features with species of the recently revised *pulchella*-group [Sinev, 2001, 2002], consisting of three species — *A. pulchella* King 1853, *A. cambouei* Guerne & Richard 1893 and *A. glabra* Sars, 1901. These features are listed below:

1. Narrow, relatively long postabdomen of female uniformly wide along its length. The exact shape of the postabdomen is different in *A. bromelicola* (concave dorsal, convex ventral margins) and in the *pulchella*-group (straight parallel margins). But their shapes are still very close in comparison with the majority of this genus, where the postabdomen is wider and shorter, and usually is narrowing distally, or, sometimes, with convex dorsal margin. Only *A. karelica* has a postabdomen of the same proportions. Both *A. bromelicola* and species of the *pulchella*-group also have a prominent dorso-distal angle of the postabdomen. This feature is also found in *A. karelica* and in some other *Alona*, such as *A. costata*, *A. guttata* Sars, 1862, but in many species it is, in contrast, broadly rounded.

2. Postero-dorsal corner of valves with numerous (40–60 or even 100) short setules of equal length, not organized into groups. In the majority of *Alona*, the postero-dorsal corner is armed with smaller number (up to 40) of setules or sometimes lacking them, and a vertical row of setules on the inner size of valve begins

from the base of the posteriormost seta of the ventral margin. In many species these setules are also of unequal length and organised into groups.

3. First endite of limb I with two setae only, while in most *Alona* a third seta, usually pointed to the base of limb is present. Only a few other species, such as *A. guttata*, *A. werestschagini*, *A. azorica*, lack it [Alonso, 1996; Sinev, 1999b].

4. IDL with three setae, with first setae of a moderate length, two others armed with short setules distally. This type of IDL armament is present in many other species of genus, *A. karelica* among them, but the similarity of it is usually observed in groups of related species, such as the *affinis*- or *costata*-group.

5. Like *A. glabra* Sars, 1901 and *A. cambouei* Guerne & Richard 1893, *A. bromelicola* has an elongated, narrow, irregular exopodite II with very short seta and several clusters of setules (in *A. pulchella* it is more rounded). In most other species, exopodite II is more broad, and the length of its seta is no less than half of exopodite length.

6. The general shapes of exopodites III–V are similar in the discussed species, they differ mostly in proportions of setae. The degree of differences between them is same as that observed between species of the *costata*-group [Sinev, 1999a], while the diversity of shapes of exopodites III–V within the genus is great.

7. Two closest to endite setae of exopodite IV are plumose, like all other exopodite setae. In other species, these setae are either naked or provided with very short setules in their proximal part only.

8. The shape of the male postabdomen in *A. bromelicola* is similar to that of *A. cambouei* and *A. glabra* (male of *A. pulchella* is unknown [Sinev, 2001]). In both cases male postabdomens are relatively short, with parallel margins in distal part, well-expressed preanal and not expressed postanal angles. Postabdomen of *A. bromelicola* male differs from that of *pulchella*-group in a prominent dorso-distal angle, but, like the postabdomens of females, their shapes are very similar in comparison with the majority of the genus, where diversity of male postabdomens is great. Again, *A. karelica* have a postabdomen of the same proportions, and while its general shape is closer to that of the *pulchella*-group, in morphology of postabdominal claw it is similar to *A. bromelicola*.

All these species are also of moderate size (length of adult female 0.35–0.55 mm), have three major head pores, and lack limb VI. All these features show that *A. bromelicola* is undoubtedly related to the *pulchella*-group. But the differences between *A. bromelicola* and species of the *pulchella*-group are also numerous. In addition to the unique traits listed above, *A. bromelicola* differs from species of the *pulchella*-group in the densely setulated setae of endite 3 of limb I, well-developed 2nd–4th setae on the inner portion of limb IV and a well-developed inner portion of limb III, so *A. bromelicola* cannot be placed within the *pulchella*-group.

At present, taxonomy of the genus *Alona* is far from developed. It consists of several groups of species, different from each other and from the type species, *A. quadrangularis* (O.F. Müller, 1785) (only one species, the

Baikal endemic *A. setosocaudata* Vasiljeva & Smirnov, 1969 seems to be closely related to it [Sinev & Kotov, 2001]). Numerous not well-known species create a sense of continuum between these groups. Marginal groups and species will possibly follow the fate of the *karua*-group, separated into the genus *Karualona* Dumont & Silva-Briano, 2000. But the *pulchella*-group seems to be one of the “core” groups of the genus whose place within genus was never questioned, and it is unlikely that it will be separated from *Alona*. It can be concluded that despite the unique characters, developed during adaptation to habitat conditions unique for the genus, strong relationships with the *pulchella*-group make *A. bromelicola* a “true” *Alona*, and in case of separation of the genus to subgenera it should be placed together with this group.

It was already suggested that *A. karelica* also may be related to the *pulchella*-group [Sinev, 2001], and the affinities between *A. bromelicola* and *A. karelica*, listed above, confirm this opinion. But the exact level of relationship between these species can be determined only after detailed morphological study of *A. karelica*, because the structure of trunk limbs is still unknown for the latter species.

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