



<http://dx.doi.org/10.11646/zootaxa.3841.2.2>

<http://zoobank.org/urn:lsid:zoobank.org:pub:DCED6990-9B2B-49F8-9E6C-6355B5DF3F05>

## Revision of the Holarctic genus *Rhynchotalona* Norman, 1903 (Anomopoda: Chydoridae)

ARTEM Y. SINEV<sup>1</sup> & ALEXEY A. KOTOV<sup>2</sup>

<sup>1</sup>Department of Invertebrate Zoology, Biological Faculty, M.V. Lomonosov Moscow State University, Leninskie Gory, Moscow 119991, Russia. E-mail: [artemsinev@yandex.ru](mailto:artemsinev@yandex.ru)

<sup>2</sup>A. N. Severtsov Institute of Ecology and Evolution, Leninsky Prospect 33, Moscow 119071, Russia.  
E-mail: [alexey-a-kotov@yandex.ru](mailto:alexey-a-kotov@yandex.ru)

### Abstract

We revise the Holarctic genus *Rhynchotalona* Norman, 1903 (Anomopoda: Chydoridae). Palaeartic *R. falcata* (Sars, 1862) is redescribed, including morphology of thoracic limbs and gamogenetic stages. North American populations previously identified as *R. falcata*, revealed two new species of the genus. *R. weiri* sp. nov. differs from *R. falcata* in smaller size, much shorter rostrum, different shape of main head pore and different morphology of postabdomen in male and female. *R. longisteta* sp. nov. differs from *R. falcata* in long posterior setae of the valve postero-ventral portion. Both new species also differ from each other and from *R. falcata* in the morphology of thoracic limbs. Our data suggests that the Palaeartic *R. falcata* is absent in North America, confirming Frey's non-cosmopolitanism paradigm for the Chydoridae. The genus diagnosis is emended, taking into consideration the newly described taxa. A key for species determination is provided.

**Key words:** Anomopoda, *Rhynchotalona*, systematics, morphology, new species, North-East USA

### Introduction

Comparative studies of Chydoridae (Branchiopoda: Anomopoda) from North America and Eurasia, conducted mostly by Prof. David G. Frey and alumni (Frey, 1980, 1985, 1988; Michael & Frey 1983, 1984, Kubersky, 1977) revealed that in North America many Eurasian taxa are replaced by closely related species. These studies became a base for the “Frey’s non-cosmopolitanism paradigm” (Frey 1982, 1987), now universally accepted in the cladoceran taxonomy (Kotov *et al.* 2010a; Xu *et al.*, 2009). But after the death of D. G. Frey taxonomical studies of Chydoridae in USA and Canada came to a standstill, and many names of European species are still applied to North American populations. Few taxonomical works have been published on the Chydoridae of USA and Canada during this century (Sinev, 2009, 2013; Sinev & Atroschenko, 2011) in contrast to Mexico which has been intensively investigated during last decade (Kotov & Elías-Gutiérrez, 2002, 2004; Kotov *et al.*, 2003; Elías-Gutiérrez *et al.*, 1997, 2001, 2006; Elías-Gutiérrez & Valdes-Morena, 2008; Sinev & Silva-Briano, 2012; Sinev & Zawisza, 2013).

The genus *Rhynchotalona* Norman, 1903 (Chydoridae: Aloninae) can be easily differentiated from all other alonines by its long rostrum. After the description of *Disparalona* Fryer, 1968 (Fryer, 1968), only a single species, *Rhynchotalona falcata* (Sars, 1862) remained within the genus, and, in our opinion, here the easiness of a generic identification led to a situation when possible species-level differences between populations from different regions were neglected. The taxon identified as *R. falcata* from China (Chiang & Du, 1979) recently was allocated to a new genus and species, *Nedorhynchotalona chiangi* Kotov & Sinev, 2011 (Kotov & Sinev, 2011). At present, *R. falcata* is recorded from Europe, Siberia, Central Asia and North America (see Smirnov, 1971). The second species of the genus, *R. kistarae* Røen, 1973, was described from Greenland. According to Røen (1973), *R. kistarae* differs from *R. falcata* in a shorter rostrum, a specific shape of labrum, a rounded postero-dorsal corner of carapace, absence of a denticle on postero-ventral corner of carapace, and a smaller size (up to 0.32 mm). Postabdomen of *R. kistarae*,

according to illustration by Røen (1973: Fig. 3), differs from that of *R. falcata* in a more rectangular shape, different morphology of marginal denticles (all postanal denticles are large), and absence of notches on the preanal margin. So far, *R. kistarae* has been reported from Greenland only.

Morphology of European *Rhynchotalona falcata* is relatively well-studied (Alonso, 1996; Flössner, 1972, 2000; Lilleborg, 1900; Smirnov, 1971 and others), but no full description of appendages and gamogenetic stages is available. North American populations of *Rhynchotalona*, identified as *R. falcata*, have never been studied in detail. Specimens from Michigan, USA on drawings of Birge (1893, Pl XIII, figs 9-10, as *Alona falcata*) have much longer posterior setae on valves than European *R. falcata* s. str. Chengalath (1982) stated that Canadian populations of *Rhynchotalona* “show minor differences from European material” and possibly belongs to an independent species. Dodson and Frey (1991) also referred to not yet described species of *Rhynchotalona* from America. Herrick (1884: 99, Pl. I, figs. 12-13) reported (as *Alona dentata*) a species with *Rhynchotalona*-like postabdomen and *Alona*-like rostrum, but his drawings were inadequate.

Here, we study the morphology of *Rhynchotalona* populations from Eurasia and North-East USA to clarify the taxonomic status of American populations as well as the diagnosis of the genus.

## Material and methods

Animals and exuviae were selected from samples under a binocular stereoscopic microscope, placed on slides (in a drop of a glycerol-formaldehyde mixture), and studied under optical microscope *in toto* for identification and measurements. One to five specimens from each population were dissected for analysis of appendages. For SEM examination specimens were lyophilized, mounted on aluminum stubs, coated with gold, and examined under a scanning electron microscope (JEOL 840A ). Measurements were conducted using an eyepiece-micrometer; all drawings were made with a camera lucida.

Abbreviations.

**In the list of material:** DGF = collection of Prof. D. G. Frey at National Museum of Natural History (Washington DC, USA), general access number 403774. AAK = personal collection of A. A. Kotov, A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia. NNS = personal collection of Prof. N. N. Smirnov, A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia. USMN = material at the general collection National Museum of Natural History (Washington DC, USA), with specific access numbers.

**In the illustrations and text:** I–V = thoracic limbs I–V; as = accessory seta of limb I; cbs = copulatory brush seta of limb I; e1 – e3 = endites 1–3 of limb I; ep = epipodite; ex = exopodite; gfp = gnathobase filter plates of limbs II–V; IDL = inner distal lobe of limb I; IP = interpore distance (distance between anterior and posterior major head pores); ms = male seta of limb I; ODL = outer distal lobe of limb I; pep = preepipodite; PP = postpore distance (distance between posterior head pore and posterior corner of head shield); s = sensillum.

## Results

Detailed morphology of *Rhynchotalona falcata* s. str., including juvenile instars of male, was studied for the first time. Comparison between European and North American populations of *Rhynchotalona* revealed two new species, *Rhynchotalona weiri* **sp. nov.** and *Rhynchotalona longiseta* **sp. nov.**

## Order Anomopoda Sars, 1865

### Family Chydoridae Dybowski & Grochowski, 1894 emend. Frey, 1967

### Subfamily Aloninae Dybowski & Grochowski, 1894 emend. Frey, 1967

## Tribe Alonini Dybowski & Grochowski, 1894 emend. Kotov, 2000

### Genus *Rhynchotalona* Norman, 1903

Sars, 1861: 139 (*Harporhynchus*); 1862b: 289 (*Alona*, *Harporhynchus*); Herrick, 1884: 114 (section *Leptorhynchus*); Norman, 1903: 367 (*Rhynchotalona* instead of *Harporhynchus*, *Leptorhynchus* – nomina preoccupata); Smirnov, 1971: 489; Flössner, 1972: 321–322; Negrea, 1983: 322; Alonso, 1996: 373.

**Type species:** *Harporhynchus falcatus* Sars, 1862 = *Rhynchotalona falcata* (Sars, 1862) now. Typified by monotypy (Norman, 1903).

**Emended diagnosis. Female. General.** Small-sized Aloninae, body low, oval, moderately compressed laterally, with maximum height in at the middle of the body (see Fig. 1A–D, 5A–C). Height/length ratio about 0.55. Dorsal and posterior margins of valves convex, postrodorsal and postero-ventral angles broadly rounded. Moulting may be incomplete with valves from previous instars retained. Postero-ventral angle with a single denticle or without it (see Fig. 1F). Antero-ventral corner of valves an elongated protrusion with rounded tip (see Fig. 1E). Ventral margin of valves with about 40–45 densely spaced setae, about 7 anterior setae very long, next 15–10 setae short, posteriormost 20–25 setae of moderate length or very long. Sculpture of valves as longitudinal lines.

**Head** relatively large. Ocellus and eye large, of similar size. Rostrum long, about 1.5–3 length of antennule, strongly curved downward and backward (see Fig. 1G–I, 6G–F). Head shield short and broad, rostrum triangular, with bifurcated tip, posterior portion of head shield as broad elongated protrusion with rounded tip (see Fig. 5F). Major head pore as a rimmed field, compressed laterally (see Fig. 2F, 5G–H). Lateral pores minute, located close to main head pore. Labral keel moderately broad, with rounded tip.

**Thorax** 2–3 times longer than abdomen.

**Abdomen.** No abdominal joint, middle segment of abdomen not saddle-shaped.

**Postabdomen** short and narrow, with almost parallel margins (see Fig. 1J–L, 2H–D, 3A, 6H–J, 7B–C). Distal angle obtuse, rounded. Dorsal margin with anal and postanal portions of similar length. Preanal and postanal angles weakly defined. Preanal margin with shallow, numerous notches. Postanal margin with 2–3 large, sharp, slender, single marginal denticles, followed by several groups of 1–3 much smaller denticles. Postanal part with about 5–6 well-developed lateral fascicles of 3–5 thick setules, as long as distal marginal denticles; in anal portion fascicles consist of much shorter and more numerous setules. Postabdominal claw weakly curved, shorter than preanal portion of postabdomen. Basal spine short, straight, about 0.15 length of claw.

**Antennule** long and narrow (see Fig. 1N, 6J, 7D). Antennular sensory seta slender, about half length of antennule, arising at 1/3–1/2 distance from the base. Nine terminal aesthetascs, two longest, their length about half-length of antennule.

**Antenna** of moderate length (see Fig. 1M, 2J–K, 6K, 7E), antennal formula: setae 0-0-3/0-1-3, spines 1-0-1/0-0-1. Basipodite without a cluster of very long setules. Proximal segments of both branches short and broad, two times shorter than other segments. Spine on proximal segment of exopodite less than 1/2 length of middle segment. Spines from apical segments almost as long as these segments. All antennal setae of similar thickness and length.

**Thoracic limbs:** six pairs.

**Limb I** with moderately long accessory seta (see Fig. 4B–C, 8A–B). ODL with a single seta. IDL with three setae, seta 1 very short, setae 2 and 3 moderately thick, armed distally with thin setules, seta 3 without annulus. Soft setae are present on each of limb endites, soft setae of endite 1 long, of endite 2 short. Setae of endite 2 short, of similar length, only slightly longer than setae of endite 3. Endite 1 with two two-segmented setae and a long, flat seta pointed to the limb base. Ventral face of limb with 5–6 clusters of setae. Maxillar process short and broad, bearing a single seta longer than process itself.

**Limb II** with narrow, elongated exopodite and relatively long seta (see Fig. 4D, 8C). Eight scraping spines decreasing in length proximally, scraper 3 broad and armed with blunt denticles. Distal armature of gnathobase with four elongated elements. Filter plate with seven setae, two posteriormost setae remarkably shorter than others.

**Limb III** with quadrangular exopodite provided with seven setae (see Fig. 4E–G, 8D). Setae 1–5 flattened, plumose, setae 6–7 slender, thin, without long setules. Distal endite with three setae, two small sensillae located between their bases. Distal two setae long and thin, adapted for scraping, proximalmost seta flattened, with long setules unilaterally. Basal endite with 4 stiff, setulated distally setae of similar size. Four soft setae increasing in size proximally, small sensillum near the base of distalmost seta. Distal armature of gnathobase with 4 elements: an elongated, cylindrical sensillum, large geniculated seta, and two spines with fused bases. Filter plate of seven setae.

*Limb IV* with subrectangular exopodite bearing six setae (see Fig. 4H, 8E). Setae 1–4 flattened, plumose, setae 5–6 slender, thin, with short setules, seta 3 longest, all other setae more than two times shorter than seta 3. Inner portion of limb IV with four setae and small elongated sensillum (see Fig. 4I, 8F). Scraping seta (1) moderately long, three flaming-torch setae elongated, first of them (2) much thicker than two others (3–4), armed with longer, thicker setules. Small setae located between bases of two proximalmost flaming-torch setae. Soft setae of similar size, shorter than setae of filter plate. Filter plate with five setae.

*Limb V* with oval exopodite of moderate size (see Fig. 4J, 8G), with four plumose setae, seta 4 about 2/5 length of seta 1. Inner limb portion as elongated oval lobe with setulated inner margin. At inner face, two setae, distalmost 1.5 times longer than other. Filter plate with three small setae.

*Limb VI* an oval setulated lobe (see Fig. 4K, 8H).

**Male. General.** Body low oval, lower than in female (see Fig. 3G–H, 5K–J).

**Head.** Ocellus larger than eye. Rostrum long, strongly bent in proximal third, straight afterward, in ventral view broad, asymmetric, widening distally, with broadly rounded tip (see Fig. 3I).

**Postabdomen** short, narrowing distally (see Fig. 3J–K, 7F). Gonopore at the end of postabdomen, above the base of claws. No distal angle, dorsal margin directly at base of claws. Dorsal margin with anal and postanal portions of similar length. Preanal and postanal angles weakly defined. Postanal margin without any denticles or setules. Lateral fascicles of setules as in female. Postabdominal claw very short, 1.5 times shorter than preanal portion of postabdomen. Basal spine very short.

**Antennule** slightly broader than that of female (see Fig. 4L, 7G), with twelve terminal aesthetascs, three of them much broader than others, longest aesthetascs about half-length of antennules. Male seta short.

**Limb I** proximal portion as in female (see Fig. 4M–N, 8I–K). Copulatory hook U-shaped, 2 times shorter than limb itself. IDL seta 1 absent, setae 2 and 3 short and thin, much smaller than in female, male seta thin, 1.5 times shorter than IDL seta 3.

### ***Rhynchotalona falcata* (Sars, 1862)**

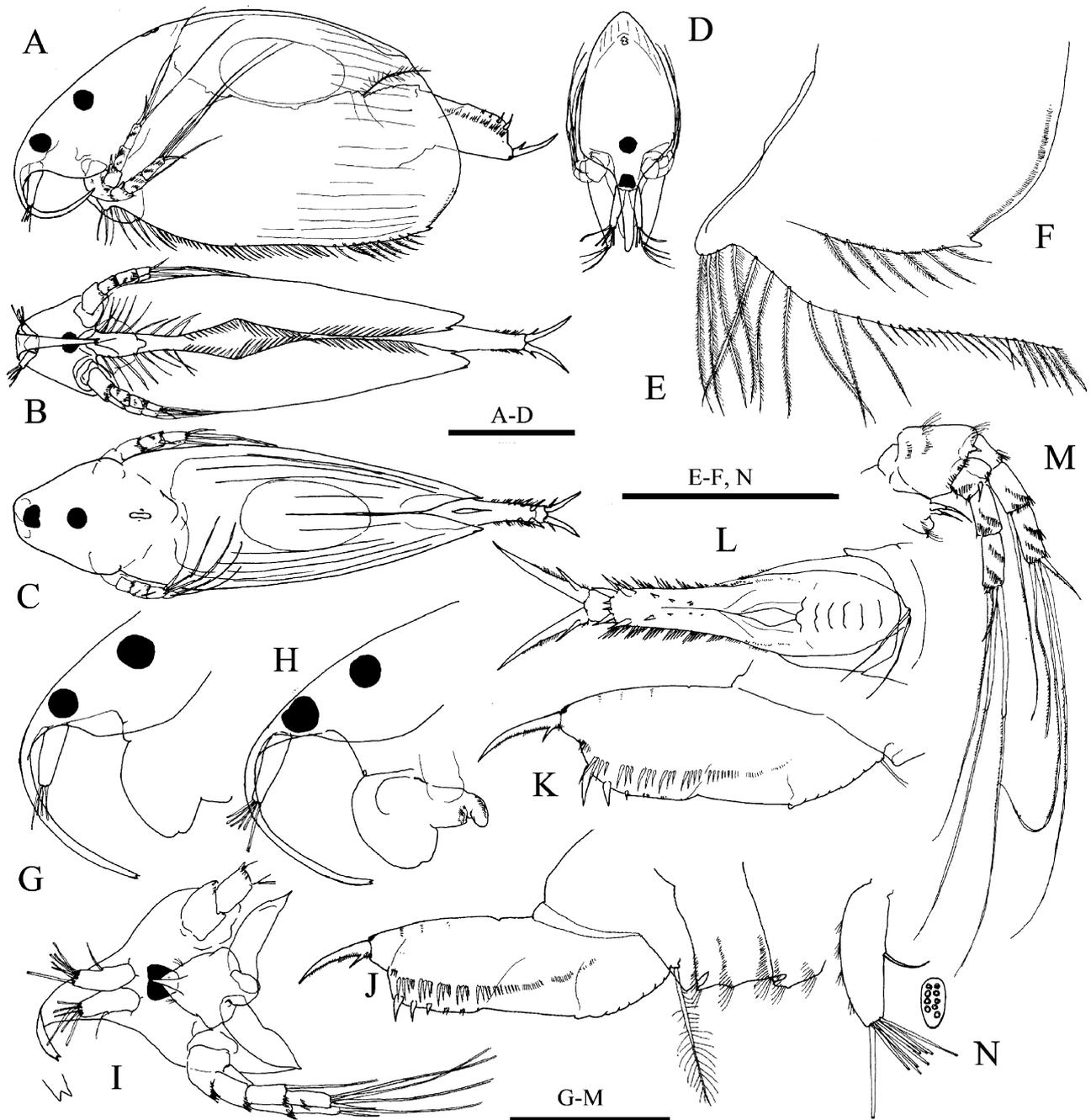
Sars, 1861 (1993): 139–141, Pl. 100: figs 1–3, Pl. 101: figs 1–7 (*Harporhynchus falcatus*, name in manuscript, published only in 1993); 1862a: 162 (*Alona*, *Harporhynchus falcatus*); Müller P.E., 1867: 183–184, Pl. 4: figs 13–14 (*Alona falcata*); Norman & Brady, 1867: 387, Pl. 18 (*Lynceus falcatus*); Hellich, 1877: 92, figs 52–53 (*Alona falcata*); Lilljeborg, 1901: 488–492, Pl. 69: figs 22–26, Pl. 70: figs 1–5 (*Leptorhynchus falcatus*); Norman, 1903: 367; Herr, 1917: 112–113, fig. 36; Behning, 1941: 274–275, fig. 113; Šrámek-Hušek *et al.*, 1962: 352–354, fig. 131; Manujlova, 1964: 236–237, fig. 121; Smirnov, 1971: 489–491, figs. 618–621; Flössner, 1972: 322–324, fig. 152; Negrea, 1983: 332–333, fig. 136; Margaritora, 1983: 158, fig. 104; Margaritora, 1985: 333–334, fig. 132; Alonso, 1996: 373–378, figs 168, 169; Flössner, 2000: 358–360, fig. 132; Kotov *et al.*, 2010b: 255, fig. 145: 9–10.

**Type locality.** Lake Marisvand (Sars, 1862), the vicinity of Oslo, Norway.

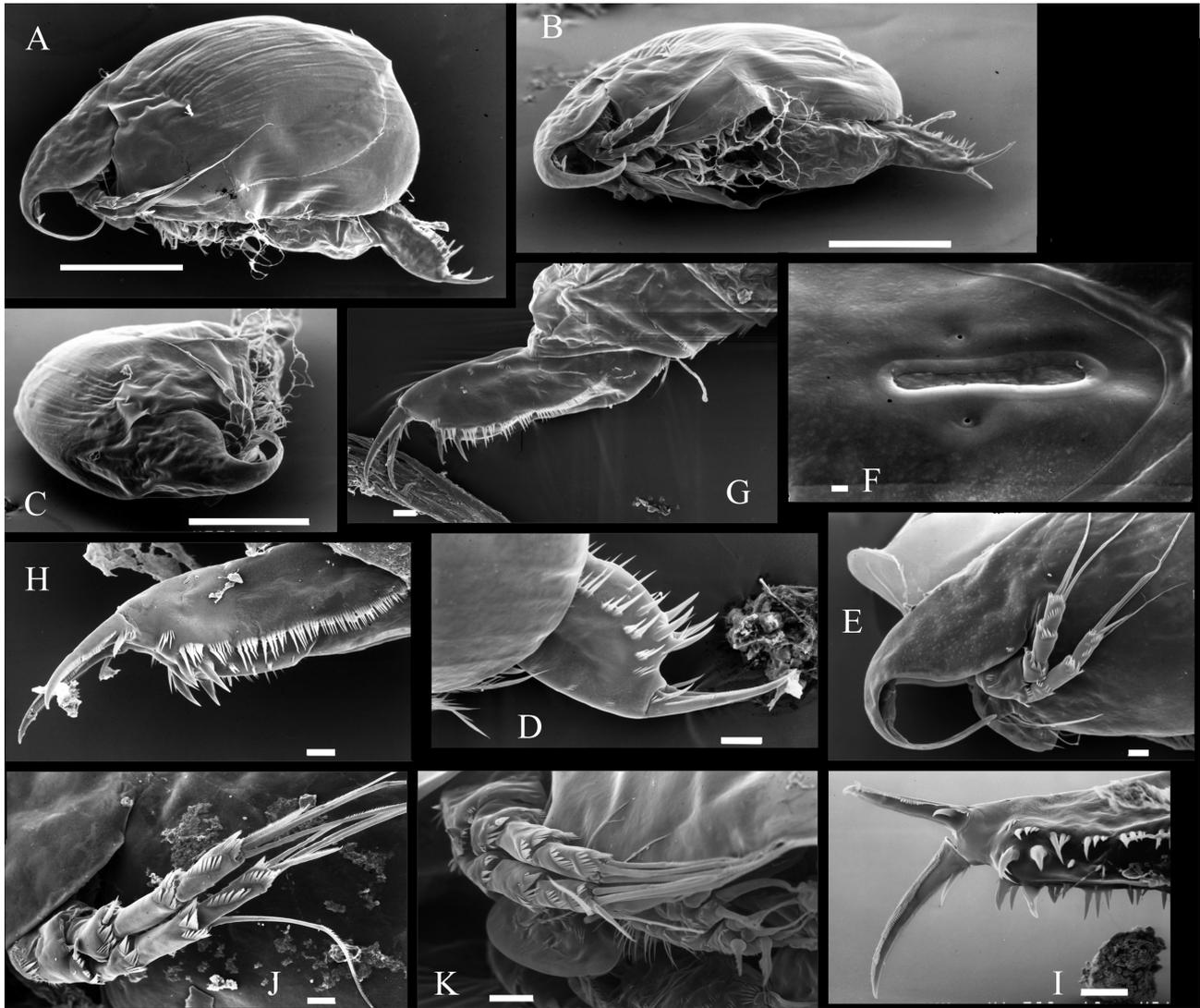
**Material studied.** 5 females and 2 males from Dofinovskiy Liman of Black Sea, near Odessa, Ukraine, slides NNS MGU 50–51, 540, 715, 977, 1926, 2022; 5 females from north portion of Lake Svyatoye, Island Bolshoy Solovetsky, Arkhangelsk Area, Russia, coll. 10.06.2012 by A. Makhrov & V. Artamonova, AAK M-2482; 3 females from Lakhta Bay, Chudskoe Lake, Pskov Area, Russia, coll. 18.08.2007 by A. A. Kotov & Y. R. Galimov, AAK M-0594; 2 females from Lake Shlino, Tver Area, Russia, coll. 14.08.2010 by T. P. Korobkova, AAK M-1799; 10 females from Pukhlinskiy Stvor, Uglich Water Reservoir, Tver Area, Russia, coll. 06.06.2010 by A. Invanovsky, AAK M-1546; 20 females from Uglich water Reservoir, Yaroslavl Area, Russia, coll. 23.08.1962 by N. N. Smirnov, NNS 1999-005 & AAK 1999-042; numerous parthenogenetic females, several males and ephippial females from Lake Glubokoe, Ruza district, Moscow area, Russia, coll. 08-09.1999, AAK 1999-088 - 089; 5 females from Lake Turgoyak near Island Svyatoy Very, Chelyabinsk Area, Russia, coll. 2011 by T. S. Dorofeeva, AAK M-2169; 6 parthenogenetic females from Usu lake, Yakutia Autonomous Republic, Russia, coll. 04.08.2010 by A. A. Kotov, AAK 2011-003; 3 parthenogenetic females from lake Bayan Nuur near town Zuungovi, Uvs Aimag, Mongolia, coll. 10.09.2006 by Ch. Jersabek, AAK 2008-090; 2 females from Hoid Gol (backwater) near Zuungovi (town), Uvs Aimag, Mongolia, coll. 11.09.2006 by Ch. Jersabek, AAK 2008-088; 2 females from Khar Nuur (Lake), Khovd Aimag, coll. 08.2010 by D.P. Karabanov, AAK M-1730; 5 females from a bay with vegetation, Hurgan Nuur, Olgii Aimag, coll. 10.08.2008 by D.P. Karabanov, AAK M-0783.

**Redescription. Parthenogenetic female. General.** Body shape (Fig. 1A–D, 2A–C) and morphology of valves (Fig. 1E–F, 2D) as for genus. Valves from previous molts retained rarely. Ventral margin of valves with posterior group of setae of moderate length.

*Head* as for genus. Rostrum long, more than two times longer than antennule, evenly curved (Fig. 1G–H, 2E). Head shield as for genus. Major head pore as elongated, narrow rimmed field, slightly narrowing in the middle, length about 4 width (Fig. 2F). Lateral head pores as for genus. Labrum as for genus, examination under high magnification reveals two lateral groups of thin setules in posterior half of the keel (Fig. 4A).



**FIGURE 1.** *Rhynchotalona falcata* from Glubokoe Lake, Ruza District, Moscow Area, Russia, parthenogenetic female. A–D, lateral, ventral, dorsal and anterior view of an adult female. E–F, antero-ventral and postero-ventral corners of valve. G–H, head in lateral view. I, head in ventral view. J–L, postabdomen. M, antennule. N, antenna. Scale bars: 0.1 mm for A–D, G–M; 0.05 mm for E–F, N.



**FIGURE 2.** *Rhynchotalona falcata* from Glubokoe Lake, Ruza District, Moscow Area, Russia, parthenogenic female. A–C, lateral, latero-ventral and anterior view. D, postero-ventral angle of valves and distal portion of postabdomen. E, head. F, head pores. G–H, postabdomen. I, postabdominal claw. J–K, antenna. Scale bar 0.1 mm for A–C; 0.01 mm for D–E, G–K; 0.001 mm for F.

*Postabdomen* (Fig. 1J–L, 2G–I) clearly narrowing distally, length about 3 height. Postanal margin with 2–3 large, sharp, slender, single marginal denticles, followed by 3 groups of 2–3 much smaller thin denticles. Lateral fascicles of setules in postanal portion consisting of 4–6 long setules, distal setules in fascicles only little shorter than distal marginal denticle. Postabdominal claw as for genus.

*Antennule* (Fig. 1N) as for genus, antennal seta arising at 1/2 distance from the base.

*Antenna* (Fig. 1M, 2J–K) as for genus. Spine on proximal segment of exopodite about than 1/3 length of middle segment. Apical spines longer than apical segments.

*Limb I* (Fig. 4B–C) as for genus, IDL setae 2–3 relatively short and robust.

*Limb II* (fig. 4d) as for genus, scraper 3 shorter and much thicker than scrapers 2 and 4.

*Limb III* (Fig. 4E–G) as for genus, exopodite two times smaller than exopodite V, length of seta 3 about 2.5 heights of exopodite.

*Limb IV* (Fig. 4H–I) as for genus, epipodite with long process, more than two times longer than epipodite itself, exopodite two times smaller than exopodite V, length of seta 3 about three heights of exopodite. Inner portion of limb with scraping seta (1) as long as largest flaming-torch seta (2).

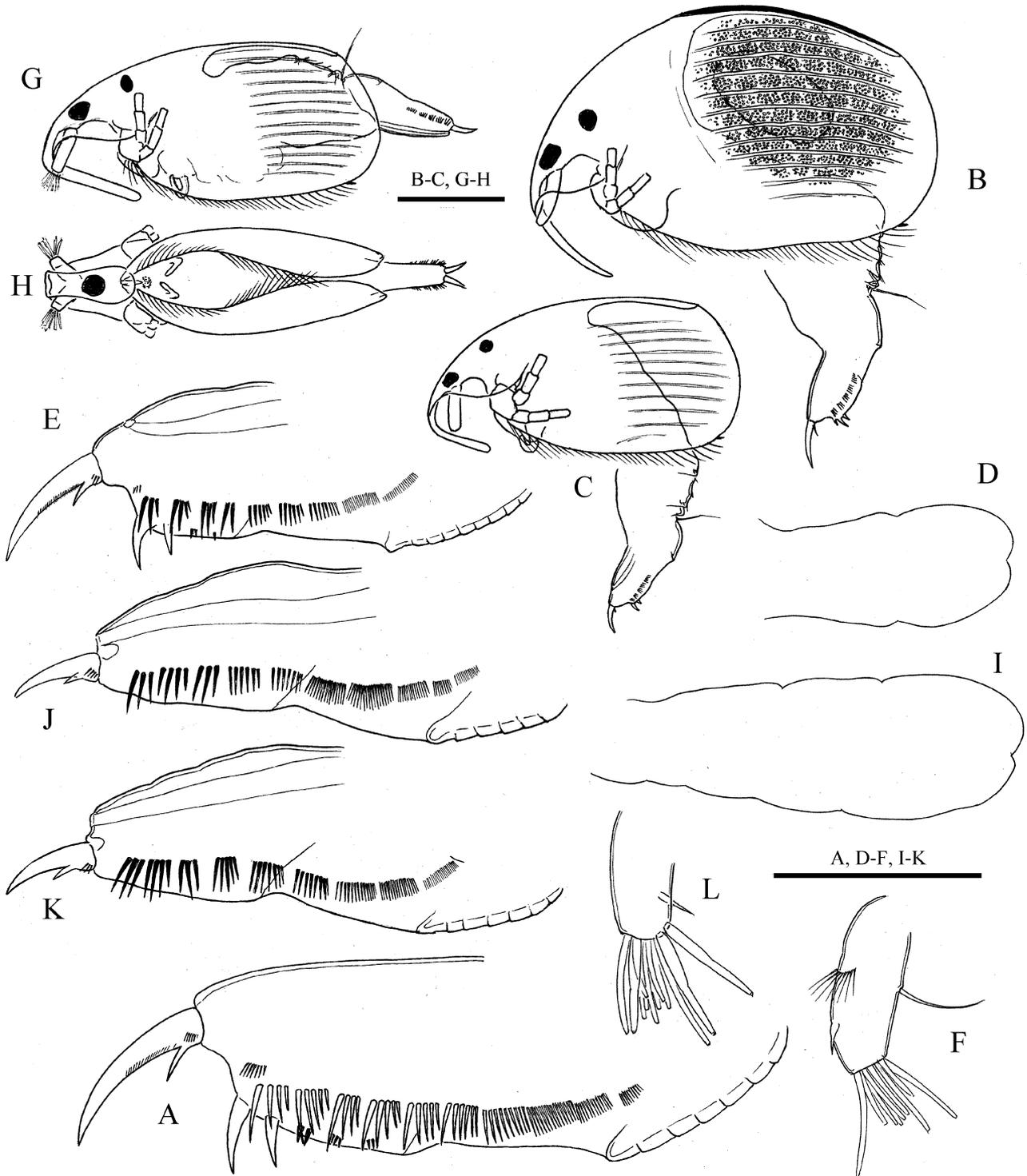
*Limb V* (Fig. 4J) as for genus.

*Limb VI* (Fig. 4K) small, much smaller than exopodites III–IV, with short, thin setules.

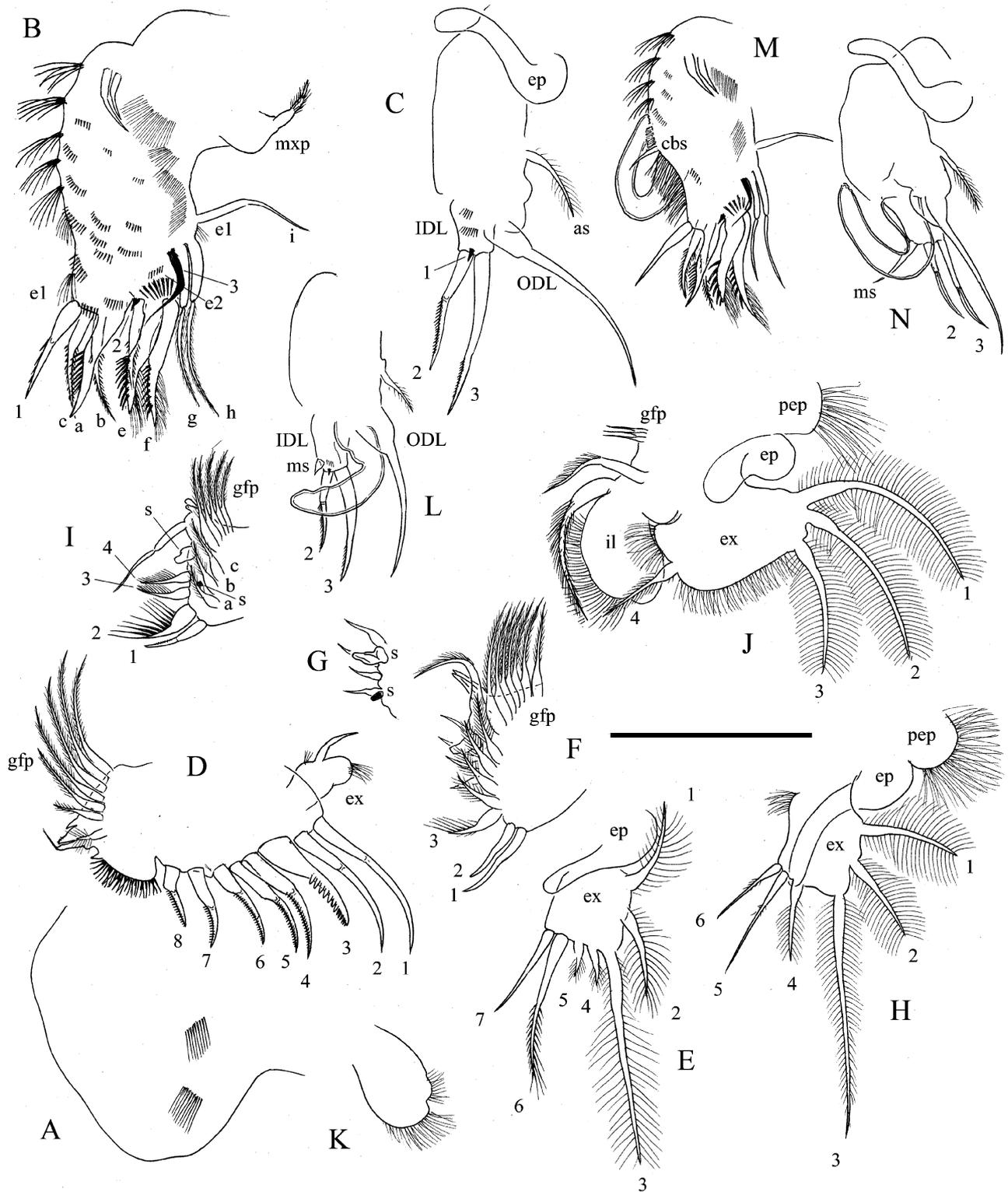
**Ephippial female.** Body outline similar to parthenogenetic female. Ephippium yellow-brown, with a sculpture of moderately thick longitudinal lines.

**Male.** Both adult and juvenile male of instar II were studied.

**General.** Body shape low oval in both juvenile (Fig. 3C ) and adult males (Fig. 3G–H), height-length ratio about 0.47–0.50. Males retaining valves from the previous molts were not observed, and not recorded in the literature.



**FIGURE 3.** *Rhynchotalona falcata* from Glubokoe Lake, Ruza District, Moscow Area, Russia. A, postabdomen of parthenogenetic female. B, ephippial female. C–F, juvenile male of instar I. C, lateral view. D, rostrum. E, postabdomen. F, antennule. G–L, adult male. G–H, same specimen in lateral view and ventral view. I, rostrum. J–K, postabdomen. L, distal part of antennule. Scale bars: 0.1 mm for B–C, G–H; 0.05 mm for A, D–F, I–K.



**FIGURE 4.** *Rhynchotalona falcata* from Glubokoe Lake, Ruza District, Moscow Area, Russia. A–H, parthenogenetic female, labrum and thoracic limbs. A, labrum. B, limb I. C, ODL and IDL of limb I. D, limb II. E, exopodite of limb III. F–G, inner portion of limb III. H, exopodite of limb IV. I, inner portion of limb IV. J, limb V. K, limb VI. L, juvenile male of instar II, ODL, copulatory hook and IDL of limb I. M–N, adult male, thoracic limb I. M, general view. N, ODL, copulatory hook, and IDL. Scale bar 0.05 mm.

*Head.* Rostrum of instar II juvenile male in lateral view shorter than in adult male, evenly curved in proximal portion and almost straight in distal portion, in ventral view (Fig. 3D), similar to that of adult male but shorter and less wide. Ocellus as large as eye. In adult male, rostrum as for genus (Fig. 3I), ocellus larger than eye.

*Postabdomen* of juvenile male of instar II (Fig. 3E) similar to that of female, but have relatively shorter postanal portion and convex ventral margin. Marginal denticles and lateral fascicles of setae same as in female. Postabdominal claw shorter than in female, basal spine shorter and more robust than in female. In adult male, postabdomen (Fig. 3J–K) as for genus, evenly narrowing in postanal portion.

*Antennule.* In juvenile male of instar II, shape of antennule (Fig. 3F) and aestetascas as in female, anlage of male seta located at 2/3 distance from the base. In adult male, antennule (Fig. 3L) as for genus, male seta located close to the end of antennule.

*Limb I.* In instar II juvenile male limb I (Fig. 4L) with short curved copulatory hook and anlage of copulatory brush seta. IDL with anlage of male seta, IDL seta 1 very small, setae 2 and 3 similar to these of female. Endites as in female. In adult male, limb I (Fig. 4M–N) as for genus, ventral face of limb below copulatory brush with about 30 long, thin, densely spaced setules.

**Size:** length of adult parthenogenetic female 0.44–0.57 mm, height 0.31–0.36 mm, length of juvenile male of instar II – 0.34–0.35 mm, height 0.17–0.18 mm, length of adult male 0.37–0.38 mm, height 0.18–0.19 mm. According to the literature, maximum length of female 0.6 mm, of male - 0.4 mm (Alonso, 1996).

**Distribution and ecology.** Europe, Kazakhstan, Siberia, Mongolia. The species inhabits open littoral in oligo- and mesotrophic lakes, and usually encountered on sandy bottom. According to Smirnov (1971), exopodites of limbs III–V in *R. falcata* lack mobility and do not perform pumping actions, thus the species require highly oxygenated waters.

### ***Rhynchotalona weiri* sp. nov.**

Herrick, 1884: Pl. I, figs 12–13 (*Alona dentata*).

**Etymology.** The species name honors Dr. Alexander Weir, director of Cranberry Lake Biological Station (SUNY ISF, USA).

**Type locality.** Long Pond, Plymouth County, Mass., USA, coll. 28.08.1961 by Eleanor Brown, number of sample in Frey's collection DGF 0602.

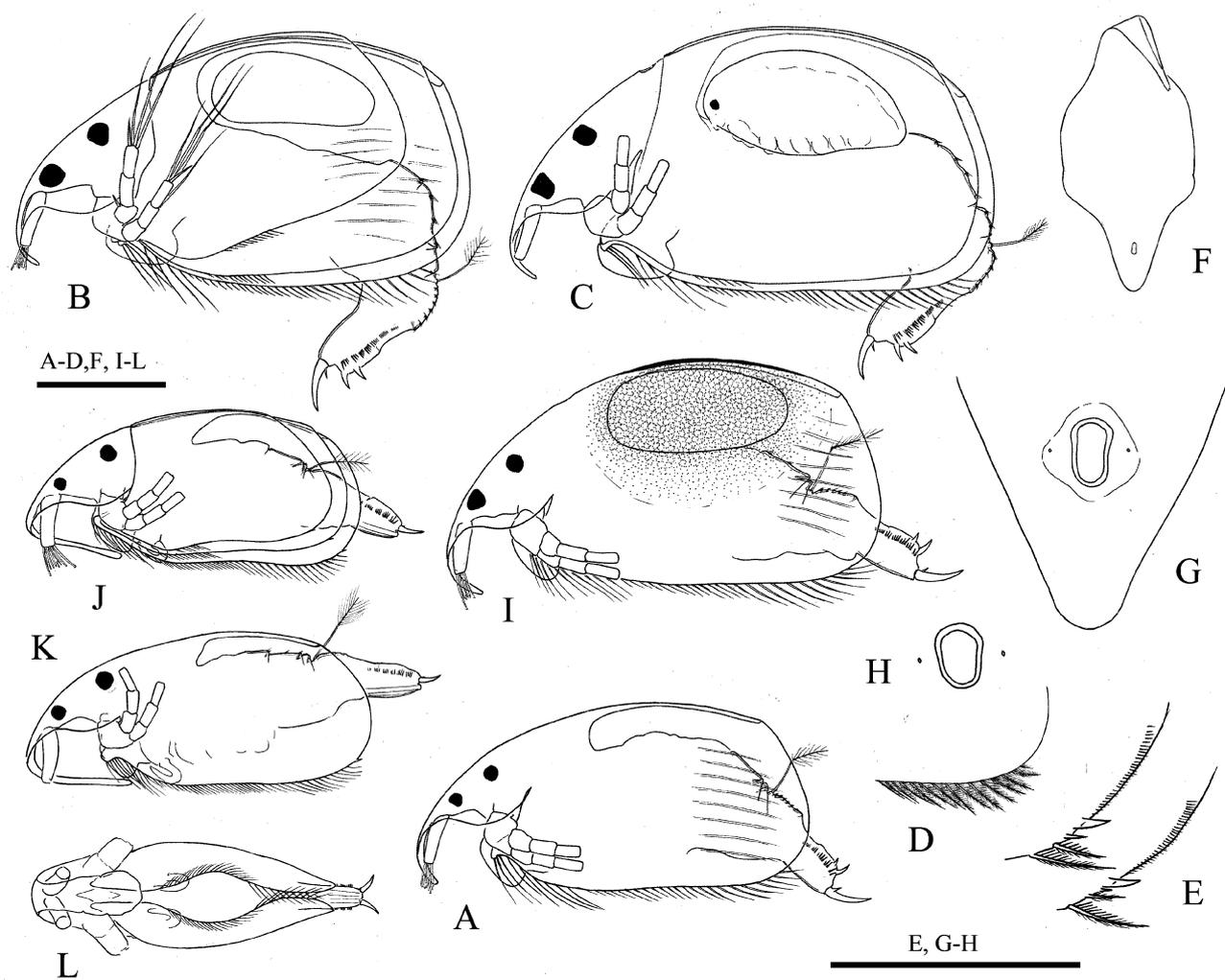
**Type material. Holotype:** parthenogenetic female from the type locality, USNM 1207841.

**Allotype:** male from the type locality, USNM 1207842.

**Paratypes.** over 40 parthenogenetic females from type locality, USNM 1207834; 14 parthenogenetic females, 2 males, paratypes, Lake of Two Rivers, Algonquin Park, Ontario, Canada, coll. 09.10.1982 by D.G. Frey, (separated from sample DGF 6450), USNM 1207833; over 40 parthenogenetic females from Cranberry Lake, St. Laurence County, N.Y., USA, coll. 08.2006, by A.Y. Sinev; several parthenogenetic females from Walden Pond, Essex County, Mass., USA, coll. 22.06.2004 by W. Pill & A. A. Kotov, AAK 2005-248.

**Diagnosis.** *Female.* *Rhynchotalona* species of small size, length up to 0.43 mm. Valves from previous molts frequently retained. Ventral margin of valves with posterior group of setae of moderate length. Rostrum short for the genus, only 1.5 times or less longer than antennule, evenly curved. Major head pore as broad, rounded rimmed field, slightly narrowing posteriorly, length about 2 width. Postabdomen narrowing distally in anal portion, in postanal portion with parallel margins, length about 3 heights. Postanal margin with 2, rarely 3 large, sharp, single marginal denticles, more robust than in the previous species, followed by 2–3 groups of 1–3 much smaller thin denticles. Lateral fascicles of setules in postanal portion consisting of 3–4, rarely 5 long setules, distal setules in fascicles only 1.5 times shorter than distal marginal denticle. Postabdominal claw as for genus. Antennule with antennal sensory seta arising at 1/3 distance from base. Antenna with spine on proximal segment of exopodite about 1/2 length of middle segment, apical spines shorter than apical segments. Limb I with IDL setae 2–3 longer and more slender than in *R. falcata*. Limb II with scraper 3 longer than scrapers 2 and 4. Exopodites III and IV of similar size with exopodite V. Limb VI large, of same size as exopodite V, with long, thick setules.

*Male.* Postabdomen with almost parallel margins in proximal half of preanal portion and strongly narrowing in distal half of postanal portion. Antennule with male seta located in its middle. Limb I with about 10 long, thin setules on ventral face of limb below copulatory brush.



**FIGURE 5.** *Rhynchotalona weiri* sp. nov. from Cranberry lake, Adirondack mountains, New York State, USA. A, juvenile female of instar II. B, adult parthenogenetic female. B–C, lateral view. D, posterior part of ventral margin of valve. E, postero-ventral angle of valves. F, head shield. G–H, head pores. I, ephippial female. J–L, adult male. J–K, lateral view. L, ventral view. Scale bars: 0.1 mm for A–D, F, I–L; 0.05 mm for E, G–H.

**Description. Parthenogenetic female. General.** Body shape (Fig. 5A–C, 6A–D) and morphology of valves (Fig. 5D–E, 6E) as for genus. Ventral margin of valves with posterior group of setae of moderate length. Valves from previous molts frequently retained.

*Head* as for genus. Rostrum short for the genus, only 1.5 times or less longer than antennule, evenly curved (Fig. 7F). Head shield (Fig. 5F) as for genus. Major head pore as broad, rounded rimmed field, slightly narrowing posteriorly; length about 2 widths (Fig. 5G–H, 6G). Lateral head pores as for genus. Labrum as for genus, examination under high magnification did not reveal any lateral groups of setules (Fig. 7A).

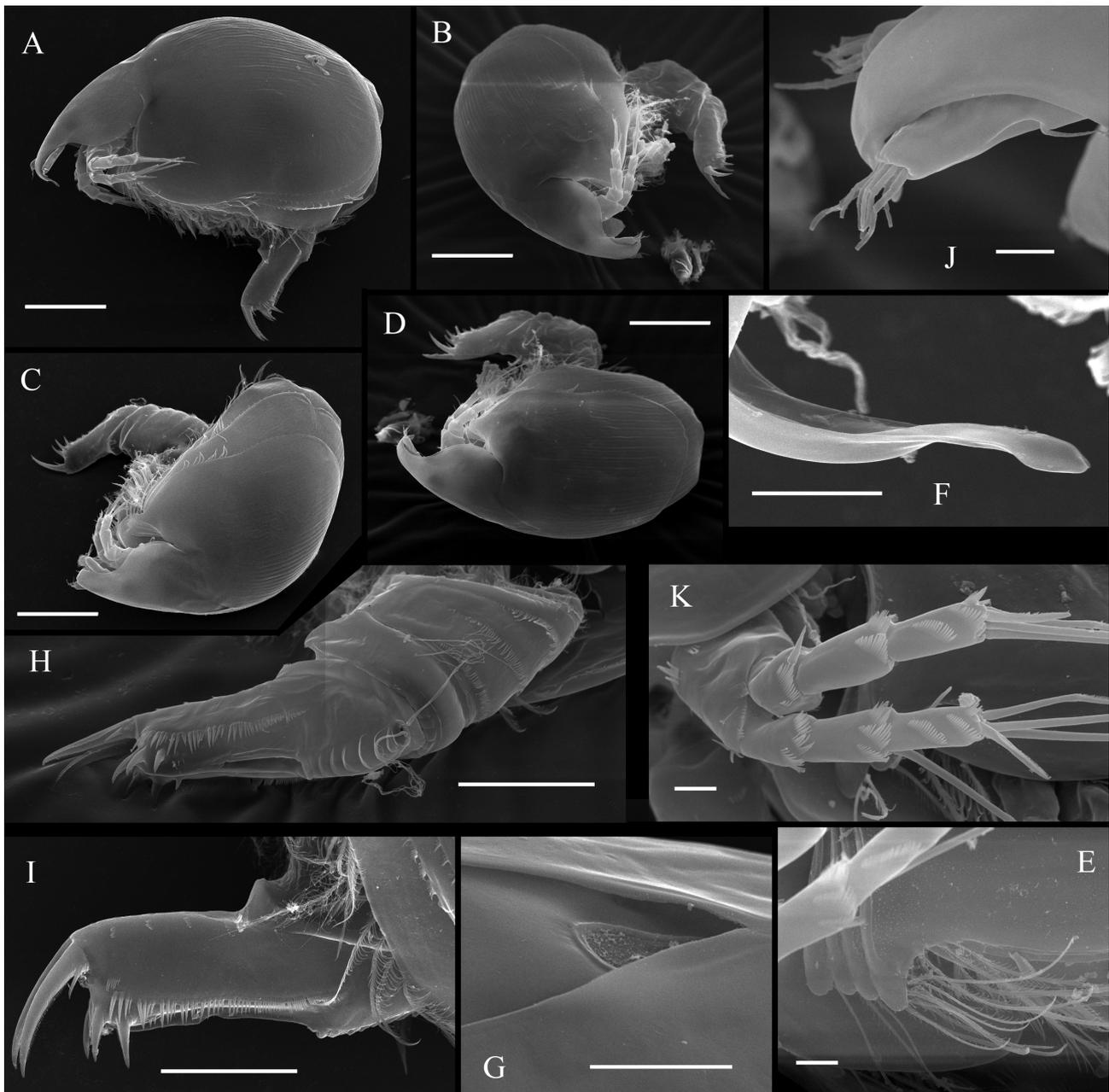
*Postabdomen* (Fig. 6H–I, 7B–C) narrowing distally in anal portion, in postanal portion with parallel margins, length about 2.8 heights. Postanal margin with 2, rarely 3 large, sharp, single marginal denticles, more robust than in the previous species, followed by 2–3 groups of 1–3 much smaller thin denticles. Lateral fascicles of setules in postanal portion consisting of 3–4, rarely 5 long setules, distal setules in fascicles only 1.5 times shorter than distal marginal denticle. Postabdominal claw as for genus.

*Antennule* as for genus (Fig. 6J, 7D), antennal seta arising at 1/3 distance from the base.

*Antenna* (Fig. 6K, 7E) as for genus. Spine on proximal segment of exopodite about 1/2 length of middle segment. Apical spines shorter than apical segments.

*Limb I* (Fig. 8A–B) as for genus, IDL setae 2–3 longer and more slender than in *R. falcata*.

*Limb II* (Fig. 8C) as for genus, scraper 3 longer and only slightly thicker than scrapers 2 and 4.



**FIGURE 6.** *Rhynchotalona weiri* sp. nov. from Cranberry lake, Adirondack mountains, New York State, USA, parthenogenetic females. A, lateral view. B–C, antero-lateral view. D, dorso-lateral view. E, antero-ventral corners of valves. F, rostrum. G, major head pore (partially covered by old valves). H, postabdomen and abdomen. I, postabdomen. J, antennule. K, antenna. Scale bars: 0.1 mm for A–D, 0.05 mm for H–I; 0.01 mm for E–G, J–K.

*Limb III* (Fig. 8D) as for genus, exopodite more large than in *R. falcata*, only 1.5 times smaller than exopodite V, length of seta 3 about four heights of exopodite.

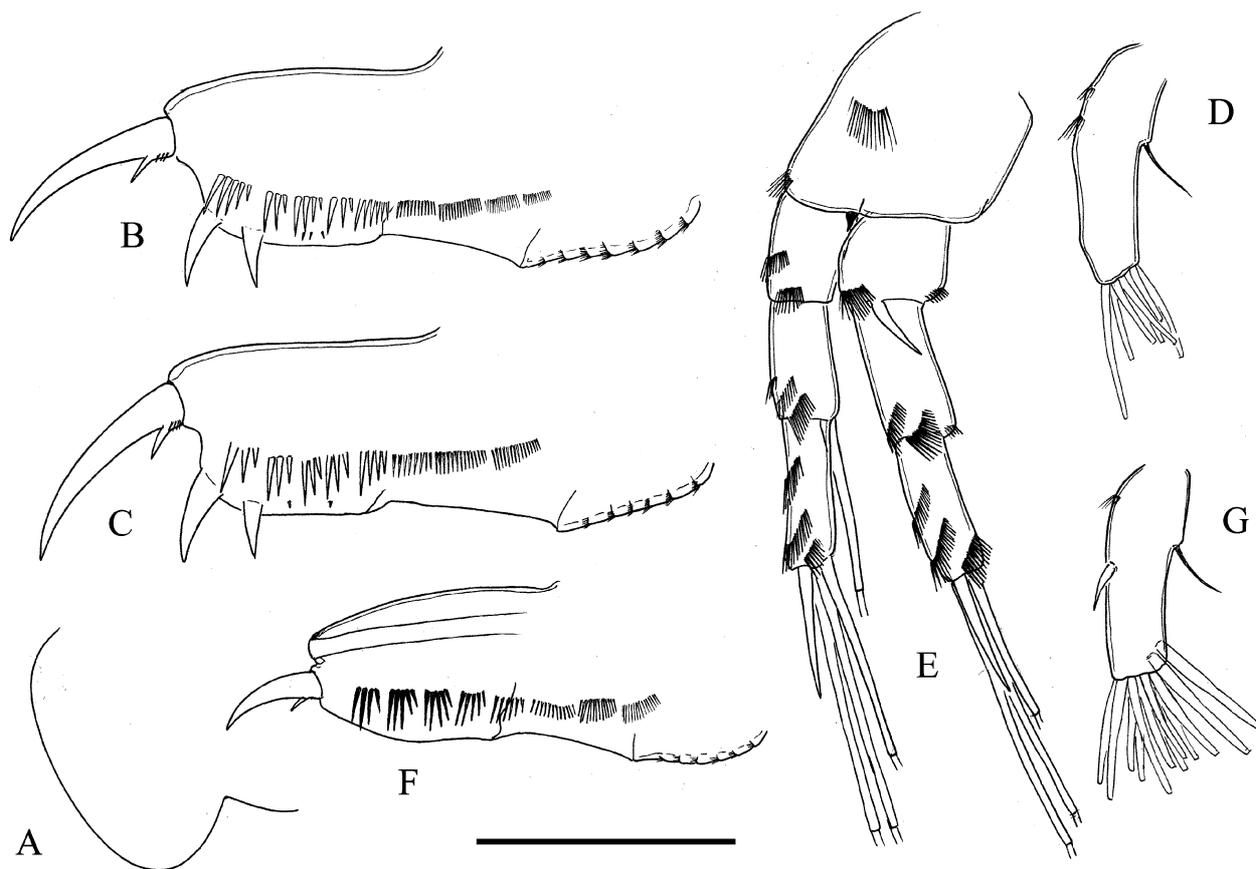
*Limb IV* (Fig. 8D–F) as for genus, epipodite with long process, more two times longer than epipodite itself, exopodite larger than in *R. falcata*, only 1.5 times smaller than exopodite V, length of seta 3 about two heights of exopodite. Inner portion of limb with scraping seta (1) as long as largest flaming-torch seta (2).

*Limb V* (Fig. 8G) as for genus.

*Limb VI* (Fig. 6H) large, of same size as exopodite V, with long, thick setules.

**Ephippial female:** Body of similar outline with parthenogenetic female. Ephippium is yellow-brown, without longitudinal lines. No specimens retaining valves from the previous molts were found in the studied material.

**Male. General.** Body shape (Fig. 5J–L) low oval, height-length ratio 0.45–0.46. Males frequently retain valves from the previous molts.



**FIGURE 7.** *Rhynchotalona weiri* sp. nov. from Cranberry lake, Adirondack mountains, New York State, USA. A–E, parthenogenetic female. A, labrum. B–C, postabdomen. D, antennule. E, antenna. F–G, male. F, postbadomen. G, antennule. Scale bar 0.05 mm.

*Head.* Rostrum as for genus, ocellus of similar size with eye.

*Postabdomen* (Fig. 7F) as for genus, smaller than in the previous species, with almost parallel margins in proximal half of preanal portion and strongly narrowing in distal half of postanal portion.

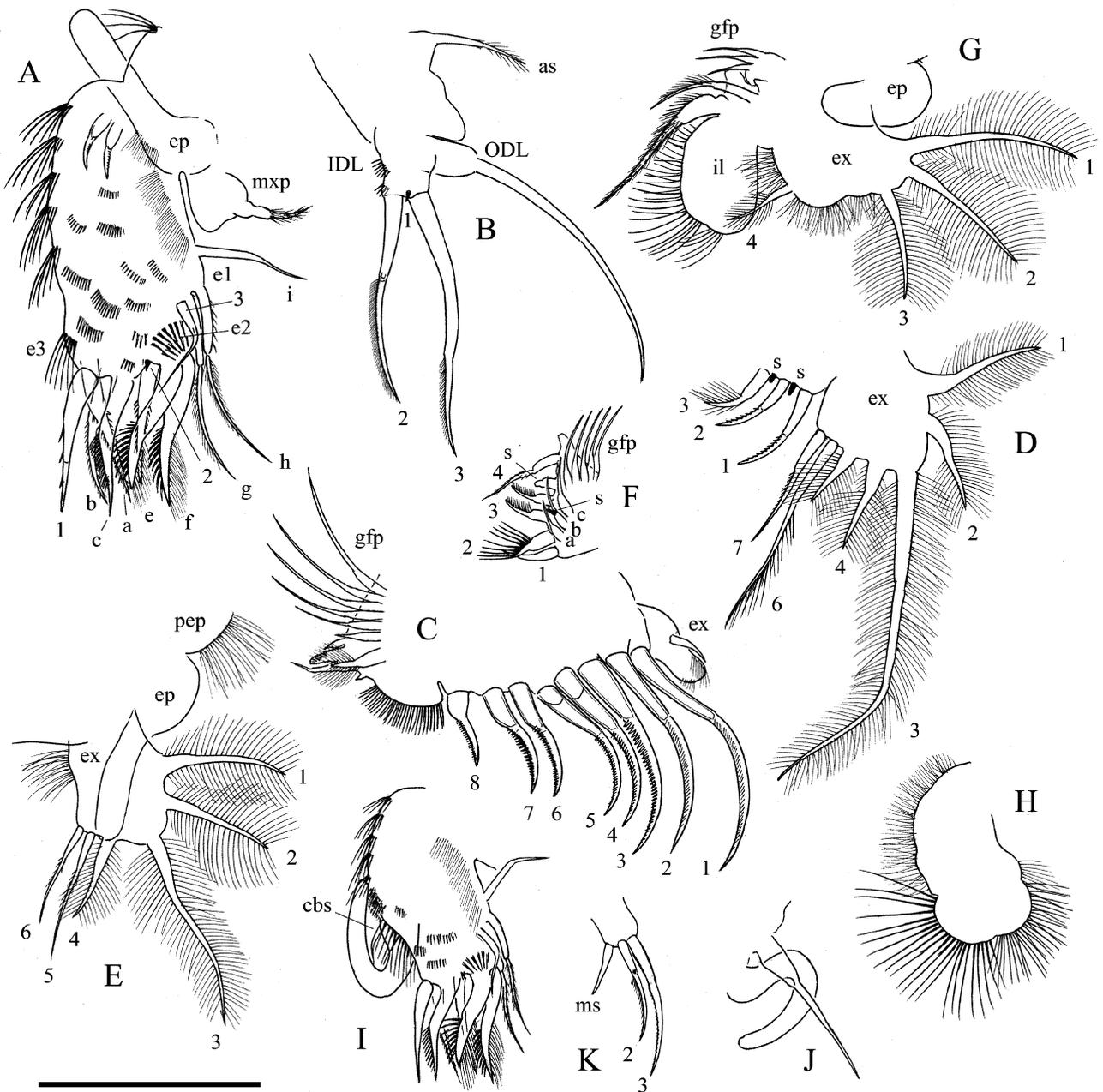
*Antennule* (Fig. 7G) as for genus, male seta located at the middle of antennule.

*Limb I* (Fig. 8I–J) as for genus, ventral face of limb below copulatory brush with about 10 long, thick setules.

**Size:** in juvenile females of instar II, length 0.35–0.36 mm, height 0.17–0.18 mm, in adult females, length 0.39–0.43 mm, height 0.20–0.24 mm. In two studied adult males, length was 0.30 and 0.31 mm, respectively; height of both specimens was 0.14 mm.

**Differential diagnosis.** *R. weiri* sp. nov. differs from from all other species of the genus by its short rostrum, shape of female postabdomen and short and wide major head pore. For other differences see Table 1.

**Distribution and ecology.** Range probably including South-East regions of Canada and North-East regions of USA, but exact borders currently unclear. In mesotrophic Cranberry lake, Adirondacks mountains, *R. weiry* sp. nov. was found in open littoral, on sandy bottom, such habitat is also typical for *R. falcata* in Eurasia (Smirnov, 1971).



**FIGURE 8.** *Rhynchotalona weiri* sp. nov. from Cranberry lake, Adirondack mountains, New York State, USA. A–H, parthenogenetic female, thoracic limbs. A, limb I. B, ODL and IDL of limb I. C, limb II. D, exopodite and distal endite of limb III. E, exopodite of limb IV. F, inner portion of limb IV. G, limb V (praepodite not shown). H, limb VI. I–K, adult male, thoracic limb I: I, general view; J, ODL and copulatory hook; I, IDL. Scale bar 0.05 mm.

**TABLE 1.** Differences between species of the genus *Rhynchotalona*.

Species	<i>R. falcata</i>	<i>R. weiri</i>	<i>R. longiseta</i>	<i>R. kistarae</i>
Female				
Size of adult	0.44–0.57(0.6) mm	0.39–0.43mm	0.43–0.52 mm	Up to 0.32 mm
Rostrum	Long, about 3 length of antennule	Short, about 1.5 length of antennule	Long about 3 length of antennule	Of moderate length, about 2 length of antennule
Posteriormost setae of valves	Short	Short	Long	Short
Main head pore	Length about 4 widths	Length about 2 widths	Length about 3 widths	Length about 3 widths
Postanal portion of postabdomen	Narrowing distally	With parallel margins	Narrowing distally	Narrowing distally
Marginal denticles of postabdomen	Large denticles located close to the end of postabdomen	Large denticles located close to the end of postabdomen	Large denticles located close to the end of postabdomen	Proximalmost large denticle located close to postanal angle
Lateral setae of postabdomen	4–6 setae in postanal fascicles	3–4, rarely 5 setae in postanal fascicles	4–6 setae in postanal fascicles	Not described in details
IDL setae	Shortened, thick	Elongated, narrow	Elongated, narrow	Unknown
Scraping seta 3 of limb II	Shorter than setae 2 and 4	Longer than setae 2 and 4	Longer than setae 2 and 4	Unknown
Exopodites III and IV	1.5 times smaller than exopodite V	Of similar size with exopodite V	1.5 times smaller than exopodite V	Unknown
Scraping seta 1 of limb IV	As long as first flaming-torch seta	As long as first flaming-torch seta	Much longer than first flaming-torch seta	Unknown
Limb VI	Smaller than exopodite V, with thin setules	Larger than exopodite V, with thick setules	Larger than exopodite V, with thin setules	Unknown
Male				
Postabdomen	Evenly narrowing distally	With parallel margins in proximal half of preanal portion, strongly narrowing in distal half	With parallel margins in proximal half of preanal portion, strongly narrowing in distal half	Unknown
Male seta of antennule	Located at 2/3 distance from base	Located at 2/3 distance from base	Located at 2/3 distance from base	Unknown
Ventral face of male limb I below copulatory brush	With about 30 thin densely spaced setules	With about 10 thick setules	With about 12 thick setules	Unknown

***Rhynchotalona longiseta* sp. nov.**

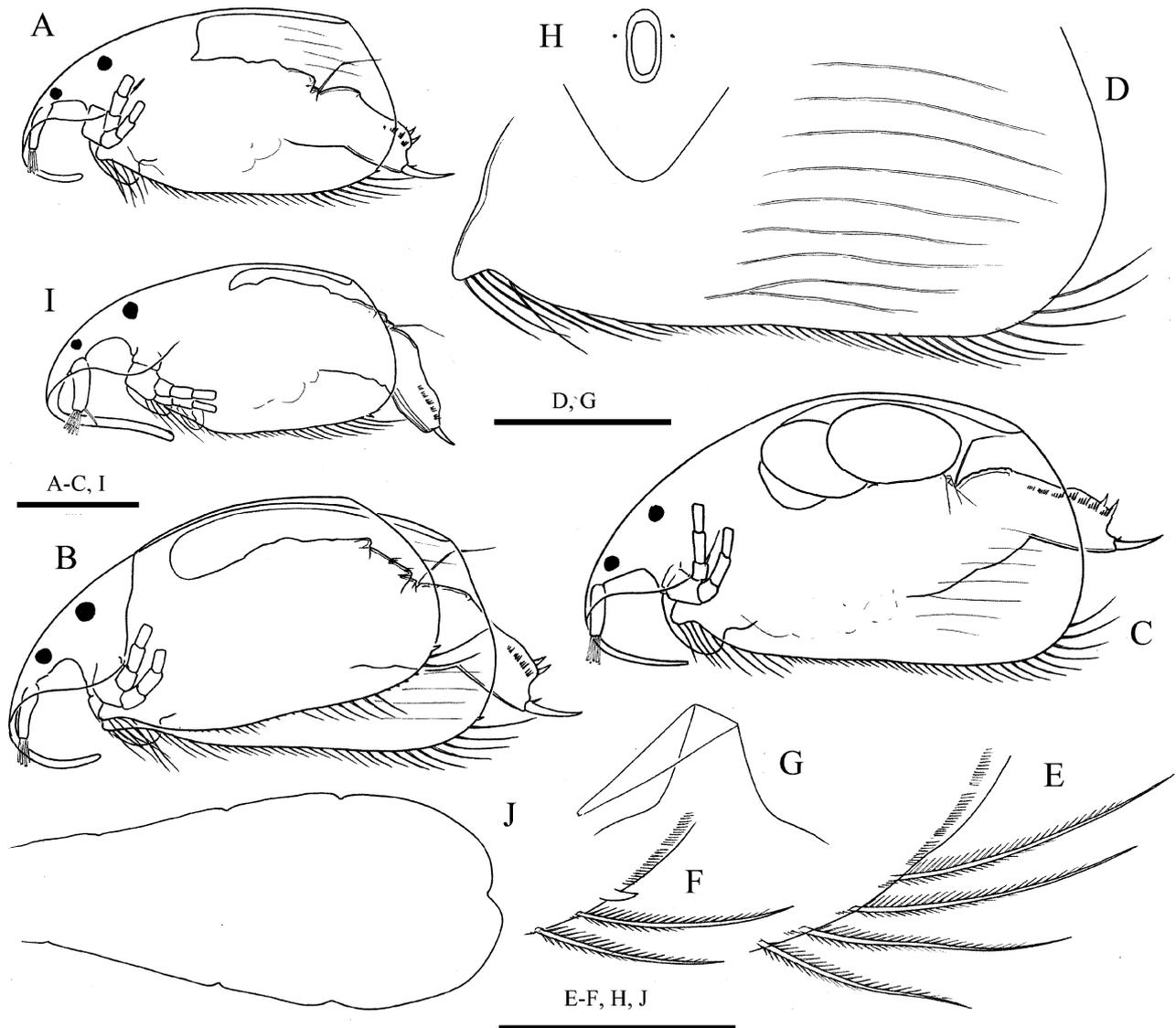
Birge 1893: Pl 13, figs 9–10 (*Alona falcata*); Birge, 1918: p. 724, fig. 1123 (*falcata*); Dodson, Frey, 1991: Fig. 20–20 (*falcata*).

**Etymology.** The species name refers to its most characteristic feature, very long posteriormost setae of ventral margin of valves.

**Type locality.** Smoke lake, Algonquin Park, Ontario, Canada, coll. 09.10.1982 by D.G Frey, (number of sample in Frey's collection DGF 6452).

**Type material. Holotype:** female from type locality, USNM 1207839.

**Allotype:** male from type locality, USNM 1207840.



**FIGURE 9.** *Rhynchotalona longiseta* sp. nov. A–I, from Lake of Two Rivers, Algonquin Park, Ontario, Canada. A, juvenile female of instar II. B–H, parthenogenetic female. B–C, lateral view. D, ventral portion of valve. E–F, postero-ventral corner of valves. G, rostrum of flattened head shield. H, head pores. I–J, adult male Smoke lake, Algonquin Park, Ontario, Canada. I, lateral view. J, rostrum. Scale bars: 0.01 mm for A–C, I and D, G; 0.05 mm for E–F, H, J.

**Paratypes:** 10 females, from the type locality, USNM 1207831; 30 parthenogenetic females, from Lake of Two Rivers, Algonquin Park, Ontario, Canada, coll. 09.10.1982 by D.G. Frey (separated from sample DGF 6450), USNM 1207832 over 100 parthenogenetic females from white Lake, Blanden County, North Carolina, USA, coll. 27.02.1979 by D.G. Frey DGF 4998.

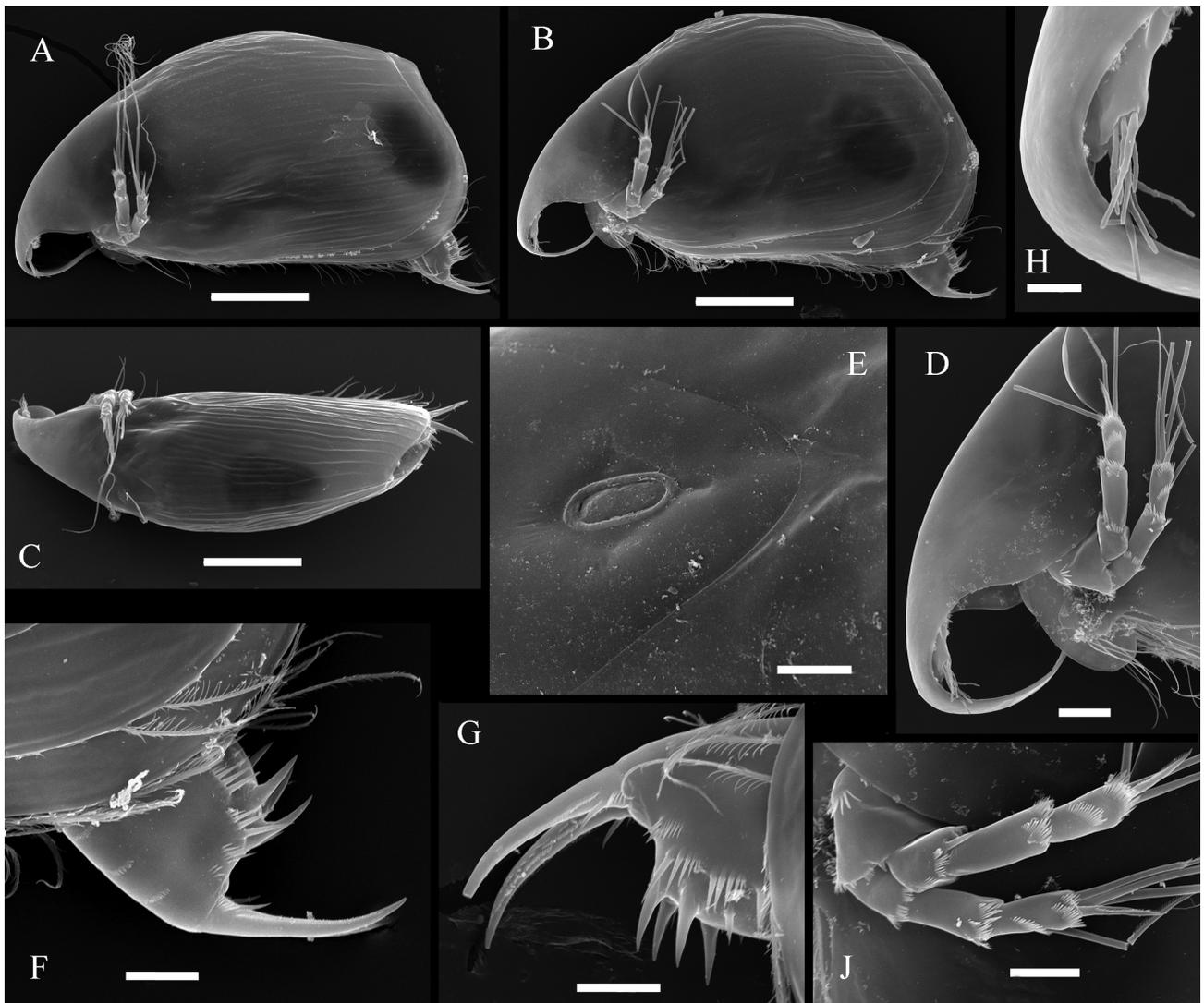
**Diagnosis.** *Female.* *Rhynchotalona* species of moderate size, length up to 0.52 mm. Valves from previous molts rarely retained. Ventral margin of valves with very long setae of posterior group, distalmost setae being longest. Rostrum long, exceeding 2 length of antennule. Major head pore as elongated rimmed field, length about 3 width. Postabdomen narrowing distally in anal portion; in postanal portion with parallel margins, length about three times height. Postanal margin with 2, rarely 3 large, sharp, single marginal denticles, followed by 2–3 groups of 1–3 much smaller thin denticles. Lateral fascicles of setules in postanal portion consisting of 4–6 long setules, distal setules in fascicles slightly shorter than distal marginal denticle. Antennule with antennal sensory seta arising at 1/2 distance from the base. Antenna with spine on proximal segment of exopodite about 1/3 length of middle segment, apical spines shorter than apical segments. Limb I with IDL setae 2–3 moderately thick and robust. Limb II with scraper 3 longer than scrapers 2 and 4. Exopodites III and IV 1.5 times smaller than exopodite V. Limb VI large, of same size as exopodite V, with thin setules.

*Male.* Postabdomen with almost parallel margins in proximal half of preanal portion and strongly narrowing in distal half of postanal portion. Antennule with male seta located at 2/3 distance from the base. Limb I with about 12 long, thin setules on ventral face of limb below copulatory brush.

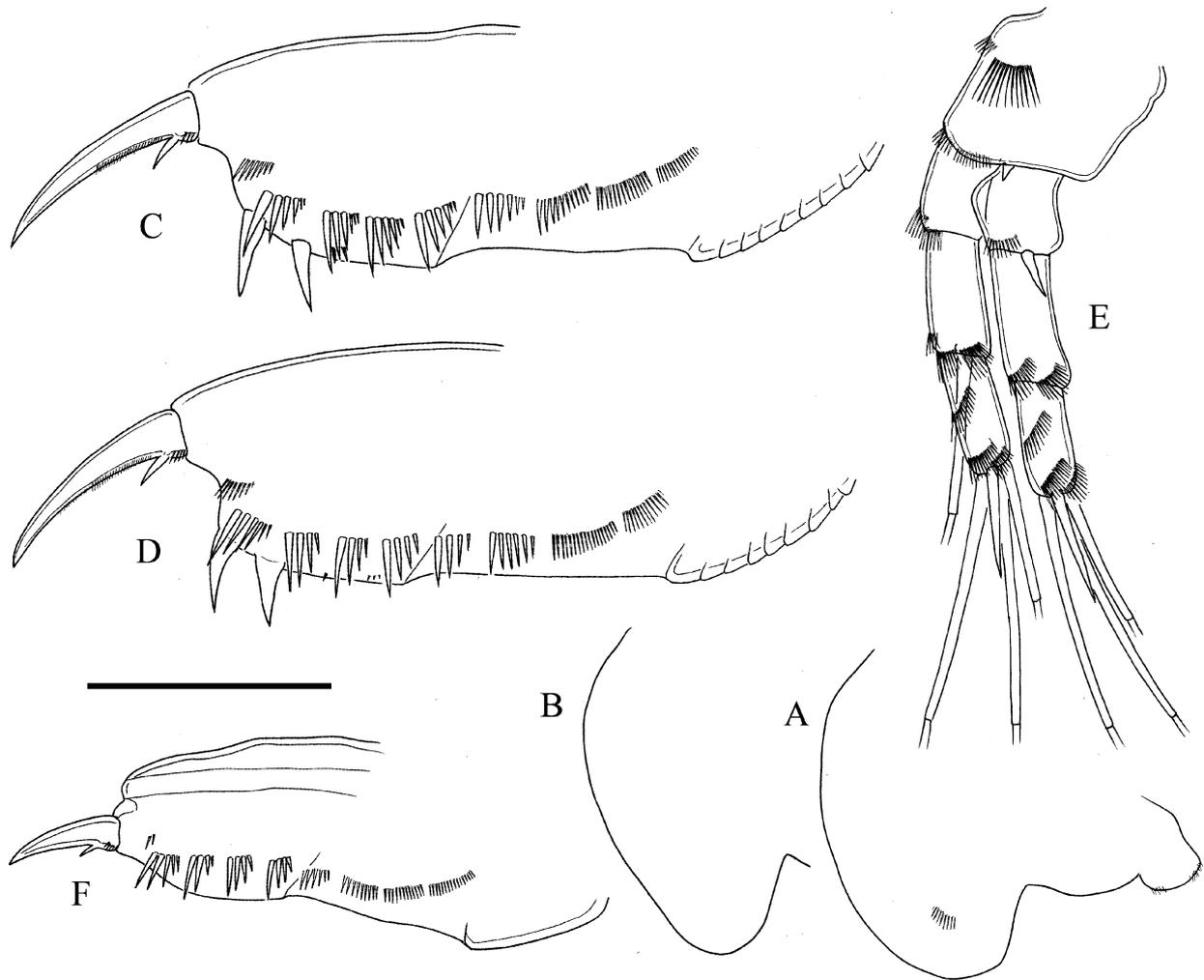
**Description. Parthenogenetic female.** *General.* Body shape (Fig. 9A–C, 10A–C) and morphology of valves (Fig. 9D) as for genus. Valves from previous molts frequently retained. Ventral margin of valves (Fig. 9D) with very long setae in posterior group (Fig. 9E–F, 10F–G), their length increasing posteriorly, posteriormost seta being longest. Postero-ventral corner of valves with or without denticle.

*Head* (Fig. 10D) as for genus. Rostrum long, more of 3 times longer than antennule, evenly curved. Head shield (Fig. 9G) as for genus. Major head pore as elongated rimmed field, length about 3 widths (Fig. 9H, 10E). Lateral head pores as for genus. Labrum as for genus, examination under high magnification reveals single lateral group of thin setules in posterior half of the keel (Fig. 11A–B).

*Postabdomen* (Fig. 10F–G, 11C–D) with parallel margins in anal portion, weakly narrowing in postanal, length about three times height. Postanal margin with 2, rarely 3 large, sharp, single marginal denticles, similar to those of *R. falcata*, followed by 2–3 groups of 1–3 much smaller thin denticles. Lateral fascicles of setules in postanal portion consisting of 4–6 long setules; distal setules in fascicles slightly shorter than distal marginal denticle. Postabdominal claw as for genus.



**FIGURE 10.** *Rhynchotalona longiseta* sp. nov., parthenogenetic female from Lake of Two Rivers, Algonquin Park, Ontario, Canada. A–B, lateral view. C, dorsal view. D, head. E, head pores. F–G, postabdomen and posteriormost setae of valves. H, antennule. I, antenna. Scale bars: 0.1 mm for A–C, 0.02 mm for D, F–H; 0.01 mm for E, I.



**FIGURE 11.** *Rhynchotalona longiseta* sp. nov. A–E, parthenogenetic female from Lake of Two Rivers, Algonquin Park, Ontario, Canada. A–B, labrum. C–D, postabdomen. E, antenna. F, postabdomen of adult male from Smoke lake, Algonquin Park, Ontario, Canada. Scale bar 0.05mm.

*Antennule* as for genus (Fig. 10H, 12A), antennal seta arising at 1/2 distance from the base. Antenna (Fig. 10J, 11E) as for genus. Spine on proximal segment of exopodite about 1/3 length of middle segment. Apical spines shorter than apical segments.

*Limb I* (Fig. 12B–C) as for genus, IDL setae as in the previous species.

*Limb II* (Fig. 12D) as in the previous species, scraper 3 longer and only slightly thicker than scrapers 2 and 4.

*Limb III* (Fig. 12E–G) as for genus, exopodite as in the previous species. Scraping setae of distal endite long and slender, with long denticles, one almost 1.5 times longer than other.

*Limb IV* (Fig. 12H–I) as for genus, epipodite with short process, about half length of epipodite itself. Setae of exopodite same as in *R. falcata*. Inner portion of limb with scraping seta (1) longer than largest flaming-torch seta (2).

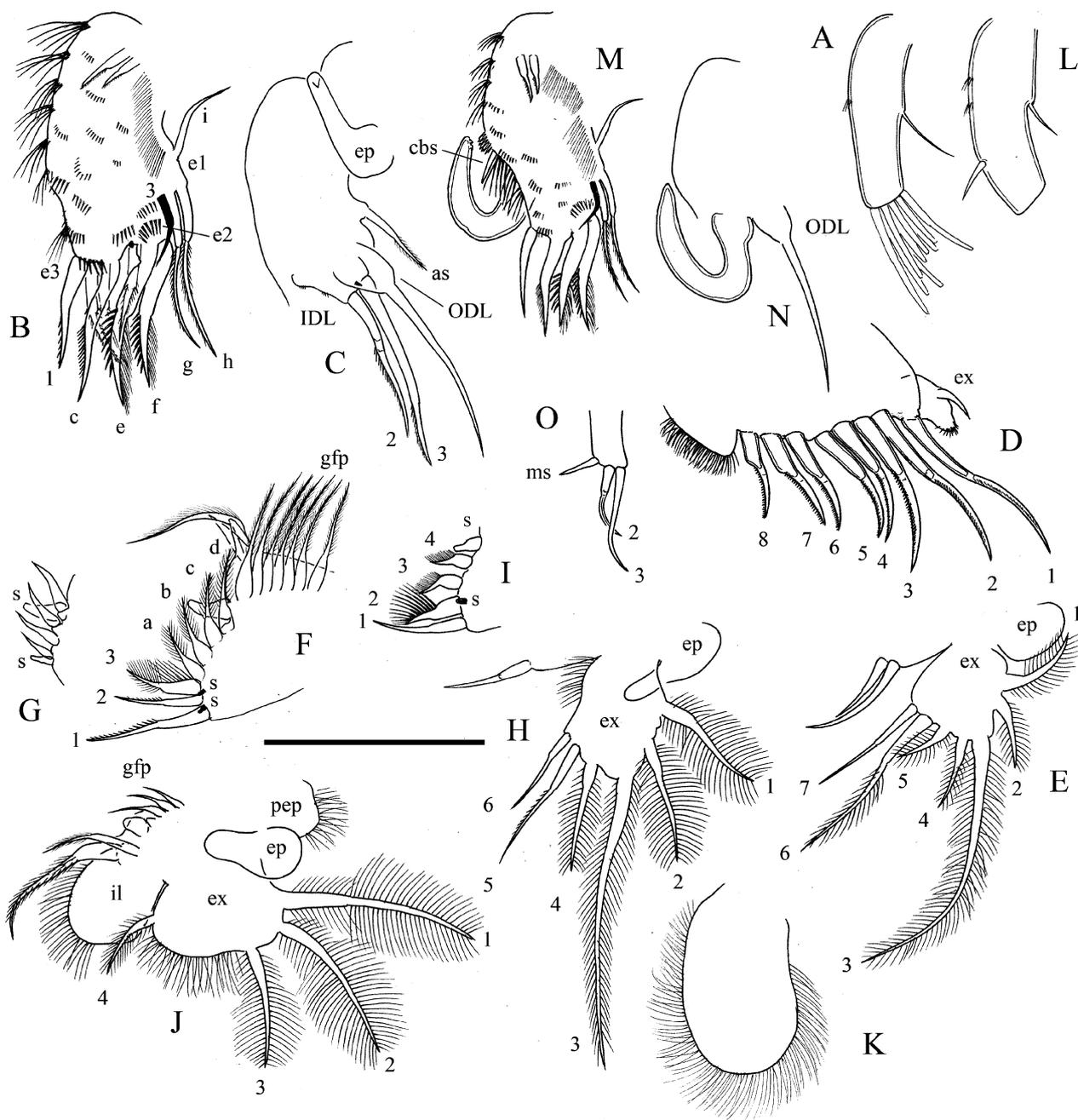
*Limb V* (Fig. 12J) as for genus.

*Limb VI* (Fig. 12K) large, larger than exopodite V, armed with thin setules.

**Male.** *General.* Only adult males were studied. Body shape low oval (Fig. 9I), height-length ratio about 0.49. Males retaining valves from the previous molts were not observed.

*Head.* Rostrum as for genus (Fig. 3J), ocellus larger than eye.

*Postabdomen* (Fig. 11F) similar to that of the previous species, with almost parallel margins in proximal half of preanal portion and strongly narrowing in distal half of postanal portion.



**FIGURE 12.** *Rhynchotalona longiseta* sp. nov. A–K, parthenogenetic female from Lake of Two Rivers, Algonquin Park, Ontario, Canada. A, antennule. B–K, thoracic limbs. B–C, limb I and its ODL and IDL. D, limb II, gnathobase not shown. E, exopodite of limb III. F–G, inner portion of limb III. H, exopodite of limb IV. I, scraping and flaming-torch setae of limb IV. J, limb V. K, limb VI. L–O, adult male from Smoke lake, Algonquin Park, Ontario, Canada. L, antennule. M–O, thoracic limb I, its copulatory hook and IDL. Scale bar 0.05 mm.

*Antennule* (Fig. 11L) as for genus, male seta located close to the end of antennule. Aestetascs were preserved badly, and we were unable to study them in detail.

*Limb I* (Fig. 11M–O) as for genus, ventral face of limb below copulatory brush with about 12 long, thick setules.

**Size:** In juvenile females of instar II, length 0.36–0.39 mm, height 0.18–0.2 mm. In adult females, length 0.42–0.52 mm, height 0.24–0.28 mm. In adult males, length 0.35–0.37 mm, height 0.17–0.18 mm.

**Differential diagnosis.** *R. longiseta* **sp. nov.** differs from all other species of the genus by long posterior setae of valves. It also differs from *R. weiri* **sp. nov.** by the long rostrum, by the shape of female and male postabdomen and by the narrow major head pore; from *R. falcata* by morphology of IDL setae and scrapers of limb II; from *R. kistarae* by longer rostrum and by the armament of postabdomen. For other differences between species, see Table 1.

**Distribution and ecology.** The distribution area probably includes South-East regions of Canada and North-East regions of USA. Ecology unknown, Dodson & Frey (1991, p. 751) refers to *R. longiseta* as “a mud dweller”, but this information should be rechecked.

### ***Rhynchotalona kistarae* Roen, 1973.**

Roen, 1973: 89–91, figs 1–4.

**Material.** Description based on published information.

**Diagnosis. Female.** *Rhynchotalona* species of small size; length 0.23–0.32 mm. Ventral margin of valves with posterior group of setae of moderate length. Rostrum about 2 times longer than antennule, evenly curved. Major head pore as elongated rimmed field, length about 3 width. Postabdomen with almost parallel margins, with three large denticles, unlike in other species, basalmost large denticle located almost at postanal angle of postabdomen.

**Male** unknown.

**Size:** length 0.23–0.32 mm, height 0.12–0.21 mm.

**Distribution.** Greenland.

### **Key for species of the genus *Rhynchotalona***

1. Rostrum short, 1.5 times or less longer than antennule ..... *R. weiri* **sp. nov.** North America.
- Rostrum long, 2–3 times longer than antennule ..... 2.
2. Posteriormost ventral setae of valves long, their length exceeding the height of postabdomen, posteriormost setae being longest ..... *R. longiseta* **sp. nov.** North America.
- Posterior ventral setae of valves short, their length much less than the height of postabdomen ..... 3
3. Basalmost large marginal denticle of postabdomen is located almost at postanal angle. Rostrum 2 times longer than antennule. Length less than 0.35 mm. .... *R. kistarae* Roen, 1973. Greenland.
- Basalmost large marginal denticle of postabdomen is located at the middle of postanal margin. Rostrum 3 times longer than antennule. Length up to 0.6 mm ..... *R. falcata* (Sars, 1862). Europe, Kazakhstan, Siberia, Mongolia.

### **Discussion**

The validity of the two new species is supported by their obvious (and relatively sharp) differences from Eurasian *R. falcata* even in external morphology: *R. weiri* **sp. nov.** in a shorter rostrum, and *R. longiseta* **sp. nov.** in specially long setae on the valve posterior margin. Both species also differ from *R. falcata* in morphology of the IDL, bearing longer and more slender setae 2–3, of the limb II, having scraper 3 longer than its neighbors, and of the limb VI, which is larger than the exopodite V. Males of both species have less numerous and more thick setules on ventral face of limb I than *R. falcata*. *R. weiri* **sp. nov.** also differs from *R. falcata* in a shorter and wider main head pore, and in shape and armament of the postabdomen. Other differences are summarized in Table 1. Both new species are also obviously different from Greenlandic *R. kistarae*.

*Rhynchotalona* is among few genera of the Aloninae with major head pore shaped like a large rimmed field. A similar pore is known for the genera *Leydigioopsis* Sars, 1901, *Tretocephala* Frey, 1965 and *Euryalona* Sars, 1901. According to Olesen (1996) it is the initial type of head pores for the subfamily Aloninae. *Leydigioopsis*, *Tretocephala* and *Euryalona* appear to be closely related to each other (Sinev, 2004b) and form a monophyletic clade within the subfamily together with *Miralona*, which have two connected head pores (Sinev, 2004a). But *Rhynchotalona* shares almost no other features with these genera (for comparison see Kotov, 2000; Rajapaksa & Fernando, 1987; Sinev 2004a–b; Van Damme & Sinev, 2013). Unlike the aforementioned, *Rhynchotalona* is (1)

small-sized, has (2) a short postabdomen with the specialized armament, (3) accessory seta and flat seta i of first endite on limb I, (4) relatively small exopodites III–V, (5) have filter plate V and (6) have limb VI, and some other differences. According to Kotov (2000) *Rhynchotalona* is among the earlier separated genera of the subfamily, and our data agree with this opinion. There is a chance that newly described *Nedorhynchotalona* (see Kotov & Sinev, 2011) is a “missing link” between *Rhynchotalona* and some other chydorid genera. Unfortunately, a phylogeny of the subfamily Aloninae still is not available, leading to misunderstanding of phylogenetic relationships between different genera.

*Rhynchotalona* is among the genera adapted to a benthic life style (Fryer, 1968). Due to this, it has some convergent characters with other benthic anomopod genera (Kotov, 2006). Some differences between the species of *Rhynchotalona* revealed here (Table 1) are analogous to those between congeners of other benthic anomopod genera. For example, taxa of the chydorinae genus *Disparalona* Fryer, 1968 have even sharper differences in the length of rostrum (Smirnov, 1971, 1996). Some species of the ilyocryptid genus *Ilyocryptus* Sars, 1862 have a bunch of specially long setae at postero-ventral angle of the valve, while others have not. Also different species of this genus have different morphology of postanal denticles, different position of in relation to anus, and different thickness of the setules on the limb VI (Kotov & Elías-Gutiérrez, 2009). Size of the major head pore is different in different species of the macrothricid genus *Macrothrix* Baird, 1843, and could be used in the diagnoses of the species (Silva-Briano, 1998). More or less narrowing postabdomen is characteristic for different taxa of *Pleuroxus* Baird, 1843 (Smirnov, 1996). Different number of lateral setae in each fascicle on the postabdomen could be observed in *Leydigia* Kurz, 1875 (Kotov, 2009). Varying morphology of the IDL setae, scrapping setae of the limb II and exopodites III–IV is recorded for the taxa of genus *Alona* Baird, 1843 *s. lato* (Smirnov, 1971). Therefore, not only the characters themselves, but also their variability is analogous among different benthic animals. Both “vertical” transformation series (homologous structures of different animals) and “horizontal” transformation series (homologous structures of the same animal) *sensu* Smirnov & Kotov (2010) could be found in benthic animals of different genera and families.

A unique feature of *Rhynchotalona* is an enlarged, flat male rostrum, exceeding in size that of female. While size of female rostrum varies in different species, size and morphology of male rostrum is almost identical in all studied species. In contrast, in other Aloninae with females having a long rostrum like species of *Leydiglopsis* and *Kurzia*, male rostrums are shortened (see Sinev, 2004b, Rajapaksa & Fernando, 1986), as long rostrums will not allow male antennules to touch the female carapace during copulation. Within Chydorinae, the situation is similar (see Smirnov, 1971, 1996). We suppose that the large flat rostrum of the *Rhynchotalona* male is pressed to the valves of female during the copulation and helps the male to grasp of female valve.

*Rhynchotalona* is a genus of limited diversity, confined only to the Holarctic region, three of four species of the genus are present in the Nearctic, and only *R. falcata* is distributed in the Palearctic. The exact ranges of American species are not known at the moment, more data are needed. According to Chengalath (1982, 1987), *Rhynchotalona* in Canada is distributed predominantly in the eastern provinces, not having been found west of the Ontario-Manitoba border. There is a possibility that *R. kistarae* is present in the polar regions of Canada as well as in Greenland, but it is unlikely that this species penetrates some temperate regions of North America. *R. falcata* is recorded from Europe, West Siberia and Kazakhstan (Smirnov, 1971), and our data confirm its presence in Mongolia and Eastern Siberia. But the easternmost margin of its distribution remains unclear. Presence of *Rhynchotalona* in China, except of a region closest to Mongolia, (Smirnov, 1971, Chiang & Du, 1979) is doubtful, all records from this area possibly belong to *Nedorhynchotalona chiangi* (see Kotov & Sinev, 2011). There are no records of *Rhynchotalona* in the Far East of Russia (see Streletskaia, 1975, 2010; Kotov *et al.*, 2011), Japan (Tanaka, 1989), Korea (Yoon, 2010) and in Alaska (Tash, 1971; Sweetman & Smol, 2006), but so far it is unclear, is *Rhynchotalona* really absent in the easternmost portion of Asian continent, or just not been found yet?

Our data shows again the insufficient level of taxonomical knowledge on the family Chydoridae in the USA and Canada. Distinctive species of *Rhynchotalona* remained undiscovered for so long because of the lack of the taxonomical efforts in the region. Unfortunately, investigators from these countries, being involved in “stylish” and “modern” projects, including genetic studies, neglect taxonomic work. We confirm “Frey’s non-cosmopolitanism paradigm” for North American *Rhynchotalona*, but still, many names of Palearctic taxa (mainly described from Europe by “classical” authors of the XVII–XIX centuries) are applied to the North American Chydoridae, as well as to other cladocerans.

## Acknowledgements

We are deeply grateful to Dr. Frank Ferrari, Dr. John Fornshell and Dr. Chad Walters (National Museum of Natural History, The Smithsonian Institution, USA) for their kind assistance and hospitality during our stays at the Museum. We are very grateful to Prof. N.N. Smirnov for help during different phases of our work. This work is supported by the Russian Science Foundation grant 14-14-00778. The SEM work is performed at User Facilities Center of M.V. Lomonosov Moscow State University under the financial support of Ministry of Education and Science of Russian Federation.

## References

- Alonso, M. (1996) *Crustacea, Branchiopoda. Vol. 7. Fauna Iberica*. Museo Nacional de Ciencias Naturales. Consejo Superior de Investigaciones Científicas, Madrid, 486 pp.
- Birge, E.A. (1893) Notes on Cladocera. III. *Transactions of the Wisconsin Academy of Science, Arts and Letters*, 9, 275–317.
- Birge, E.A. (1918) The water fleas (Cladocera). In: Ward, H.G. & Whipple, C.G. (Eds.), *Freshwater Biology*. Wiley, New York, 676–740.
- Behning, A.L. (1941) *The Cladocerans of the Caucasus*. Gruzmedgiz Publishing, Tbilisi, 384 pp. [in Russian]
- Chiang, S. & Du, N. (1979) *Fauna Sinica. Crustacea. Freshwater Cladocera*. Science Press, Academia Sinica, Peking, 297 pp.
- Chengalath, R. (1982) A faunistic and ecological survey of the littoral cladocera of Canada. *Canadian Journal of Zoology*, 60, 2668–2682.  
<http://dx.doi.org/10.1139/z82-343>
- Chengalath, R. (1987) The distribution of chydorid Cladocera in Canada. *Hydrobiologia*, 145, 151–157.  
<http://dx.doi.org/10.1007/bf02530275>
- Dodson, S.I. & Frey, D.G. (1991) Cladocera and other Branchiopoda. *Ecology and classification of North American Freshwater Invertebrates*. Academic Press, Inc., 723–786.
- Elías-Gutiérrez, M., Ciro-Perez, J., Gutierrez-Aguirre, M. & Cervantes-Martinez, A. (1997) A checklist of the littoral cladocerans from Mexico, with descriptions of five taxa recently recorded from the Neovolcanic Province. *Hydrobiologia*, 360, 63–73.  
[http://dx.doi.org/10.1007/978-94-011-4964-8\\_7](http://dx.doi.org/10.1007/978-94-011-4964-8_7)
- Elías-Gutiérrez, M., Smirnov, N.N., Suárez-Morales, E. & Dimas-Flores, N. (2001) New and little known cladocerans (Crustacea: Anomopoda) from southeastern Mexico. *Hydrobiologia*, 442, 41–54.
- Elías-Gutiérrez, M., Kotov, A.A. & Garfías-Espejo, T. (2006) Cladocera (Crustacea: Ctenopoda, Anomopoda) from southern Mexico, Belize and northern Guatemala, with some biogeographical notes. *Zootaxa*, 1119, 1–27.
- Elías-Gutiérrez, M. & Valdes-Morena, M. (2008) A new cryptic species of *Leberis* Smirnov, 1989 (Crustacea, Cladocera, Chydoridae) from the Mexican semi-desert region, highlighted by DNA barcoding. *Hidrobiológica*, 18, 63–74.
- Flössner, D. (1972) *Krebstiere, Crustacea (Kiem- und Blattfüßer: Branchiopoda, Fischläusse, Branchiura)*. Die Tierwelt Deutschlands. Gustav Fischer Verlag, Jena, 499 pp.
- Flössner, D. (2000) *Die Haplopoda und Cladocera (ohne Bosminidae) Mitteleuropas*. Backhuys, Leiden, 428 pp.
- Frey, D.G. (1980) On the plurality of *Chydorus sphaericus* (O.F. Muller) (Cladocera, Chydoridae), and designation of a neotype from Sjaelso, Denmark. *Hydrobiologia*, 69, 83–123.
- Frey, D.G. (1982) Questions concerning cosmopolitanism in Cladocera. *Archiv für Hydrobiologie*, 93, 484–502.
- Frey, D.G. (1985) A new species of the *Chydorus sphaericus* group (Cladocera, Chydoridae) from Western Montana. *Internationale Revue der gesamten Hydrobiologie und Hydrographie*, 70, 3–20.  
<http://dx.doi.org/10.1002/iroh.19850700102>
- Frey, D.G. (1987) The taxonomy and biogeography of the Cladocera. *Hydrobiologia*, 145, 5–17.  
<http://dx.doi.org/10.1007/bf02530260>
- Frey, D.G. (1988) Separation of *Pleuroxus laevis* Sars, 1861 from two resembling species in North America: *Pleuroxus stramineus* Birge, 1879 and *Pleuroxus chiangi* sp. n. (Cladocera, Chydoridae). *Canadian Journal of Zoology*, 66, 2534–2563.  
<http://dx.doi.org/10.1139/z88-376>
- Fryer, G. (1968) Evolution and adaptive radiation in the Chydoridae (Crustacea: Cladocera): a study of comparative functional morphology and ecology. *Philosophical Transactions of the Royal Society of London, Series B*, 254, 221–385.
- Herrick, C.L. (1884) A final report on the Crustacea of Minnesota. *Geological and Natural History Survey of Minnesota*, 12th annual report, 1–191.
- Hellich, B. (1877) Die Cladoceren Böhmens. *Archiv für die naturwissenschaftlichen Landesdurchforschung von Böhmen*, 3 (4), 1–131.  
<http://dx.doi.org/10.5962/bhl.title.13316>
- Herr, O. (1917) *Die Phyllopodenfauna der preussischen Oberlausitz und der benachbarten Gebiete*. *Abhandl. Naturforsch.*

- Gesellsch. Zu Goerlitz, 28, 1–162.
- Kotov, A.A. (2000) Redescription and assignment of the chydorid *Indialona ganapati* Petkovski, 1966 (Branchiopoda: Anomopoda: Aloninae) to Indialonini, new tribus. *Hydrobiologia*, 439, 161–178.
- Kotov, A.A. (2006) Adaptations of the Anomopoda (Cladocera) for benthic mode of life. *Zoologicheskyy Zhurnal*, 85 (9), 1043–1059.
- Kotov, A.A. (2009) A revision of *Leydigia* Kurz, 1875 (Anomopoda, Cladocera, Branchiopoda), and subgeneric differentiation within the genus. *Zootaxa*, 2082, 1–68.
- Kotov, A.A. & Elías-Gutiérrez, M. (2002) Analysis of the morphology of *Spinalona anophthalma* Ciro-Pérez & Elías-Gutiérrez, 1997 (Aloninae, Anomopoda, Cladocera). *Hydrobiologia*, 468, 185–192.
- Kotov, A.A. & Elías-Gutiérrez, M. (2004) Notes on Aloninae Dybowski & Grochowski, 1894 *emend.* Frey, 1967 (Cladocera: Anomopoda: Chydoridae): 2. *Leydigia* cf. *striata* Birabeén, 1939 in South Mexico. *Arthropoda Selecta*, 13 (1–2), 1–6.
- Kotov, A.A. & Elías-Gutiérrez, M. (2009) A phylogenetic analysis of *Ilyocryptus* Sars, 1862 (Cladocera: Ilyocryptidae). *International Review of Hydrobiology*, 94 (2), 208–225.  
<http://dx.doi.org/10.1002/iroh.200811102>
- Kotov, A.A. & Elías-Gutiérrez, M. & Nieto, M.G. (2003) *Leydigia louisiana* Jenkin, 1934 in the Neotropics, *L. louisiana mexicana* n. subsp. in the Central Mexican highlands. *Hydrobiologia*, 510, 239–255.  
<http://dx.doi.org/10.1023/b:hydr.0000008645.71534.81>
- Kotov, A.A., Korovchinsky, N.M., Sinev, A.Y. & Smirnov, N.N. (2011) Cladocera (Crustacea, Branchiopoda) of the Zeya basin (Amurskaya Area, Russian Federation). 3. Systematic-faunistic and zoogeographic analysis. *Zoologicheskyy Zhurnal*, 90, 402–411.
- Kotov, A.A. & Sinev, A.Y. (2011) Cladocera (Crustacea, Branchiopoda) from the Zeya river basin from the Zeya river basin. 2. Description of new taxa. *Zoologicheskyy zhurnal*, 90, 272–284.
- Kotov A.A., Sinev, A.Y. & Berrios, V.L. (2010a) The Cladocera (Crustacea: Branchiopoda) of six high altitude water bodies in the North Chilean Andes, with discussion of Andean endemism. *Zootaxa*, 2430, 1–66.
- Kotov, A.A., Sinev, A.Y., Glagolev, S.M., Smirnov, N.N. (2010b) Water fleas (Cladocera). In: Alexeev, V.R. & Tsalolokhin, S.Y. (Eds.), *Key book for zooplankton and zoobenthos of fresh waters of European Russia*. KMK, Moscow, pp. 151–276.
- Kubersky, E.S. (1977) Worldwide distribution and ecology of *Alonopsis* (Cladocera: Chydoridae) with a description of *Alonopsis americana* sp.nov. *Internationale Revue der gesamten Hydrobiologie und Hydrographie*, 62, 649–685.  
<http://dx.doi.org/10.1002/iroh.1977.3510620505>
- Lilljeborg, W. (1900) *Cladocera Sueciae*. Nova acta regiae societatis scientiarum upsalaensis, *Seriei Tertiae*, 19, 1–701.
- Manujlova, E.F. (1964) The cladocerans of fauna of the USSR. *Opredeliteli po faune SSSR*, 88, 1–327. [in Russian]
- Margaritora, F.G. (1983) Cladoceri (Crustacea, Cladocera). *Guide per il riconoscimento delle specie animali delle acque interne italiane*, Verona, 22, 1–169.
- Margaritora, F.G. (1985) Cladocera. *Fauna d'Italia Edizioni Calderini*, Bologna, 23, 1–399.
- Michael, R.G. & Frey, D.G. (1983) Assumed amphi-atlantic distribution of *Oxyurella tenuicaudis* (Cladocera, Chydoridae) denied by a new species from North America. *Hydrobiologia*, 106, 3–35.  
<http://dx.doi.org/10.1007/bf00016413>
- Michael, R.G. & Frey, D.G. (1984) Separation of *Disparalona leei* (Chien, 1970) in North America from *D. rostrata* (Koch, 1841) in Europe (Cladocera, Chydoridae). *Hydrobiologia*, 114, 81–108.  
<http://dx.doi.org/10.1007/bf00018107>
- Müller, P.E. (1867) Danmarks Cladocera. *Naturhistorisk tidsskrift*, 3, 53–240.
- Negrea, S. (1983) Cladocera. *Fauna Republicii Socialiste România, București. Crustacea*, 4, 1–399.
- Norman, C.A.M. (1903) New generic names for some Entomostraca and Cirripedia. *Annals of Magazine of Natural History*, Series 7, 11, 367–369.
- Norman, A.M. & Brady, G.S. (1867) A monograph of the British Entomostraca belonging to the families Bosminidae, Macrothricidae and Lynceidae. *Natural History Transactions of Northumberland and Durham*, 1, 354–408.
- Olesen, J. (1996) External morphology and phylogenetic significance of the dorsal/neck organ in the Conchostraca and head pores of the cladoceran family Chydoridae (Crustacea, Branchiopoda). *Hydrobiologia*, 330, 213–226.  
<http://dx.doi.org/10.1007/bf00024209>
- Rajapaksa, R. & Fernando, C.H. (1986) Tropical species of *Kurzia* (Crustacea, Cladocera) with a description of *Kurzia brevilabris* sp. nov. *Canadian Journal of Zoology*, 64, 2590–2602.  
<http://dx.doi.org/10.1139/z86-379>
- Rajapaksa, R. & Fernando, C.H. (1987) A redescription of *Euryalona orientalis* (Daday, 1898), with a consideration of the other species in the genus *Euryalona* (Cladocera: Chydoridae). *Hydrobiologia*, 150, 75–90.  
<http://dx.doi.org/10.1007/bf00006611>
- Røen, U. (1973) *Rhynchotalona kistaræ* sp.n. from South Greenland (Crustacea, Cladocera, Chydoridae, Aloninae). *Steenstrupia*, 3, 89–92.
- Sars, G.O. [1861] (1993) Om de i Christiania's omegn forekommende ferskvandskredsdyr. - On the freshwater Crustacea occurring in the vicinity of Christiania. University of Bergen, Norway, 199 pp.
- Sars, G.O. (1862a) *Hr. Studios medic. G. O. Sars meddeelte en afdalrige Afbildninger ledsaget Oversigt af de af ham i Omegnen*

- af *Christiania iagttagne Crustacea cladocera*. Forh. VidenskSelsk. Krist, Aar 1861, 144–167.
- Silva-Briano, M. (1998) A revision of the Macrothricid-like anomopods, *Ph. D. Thesis Universiteit Ghent*, 388 pp.
- Sinev, A.Y. (2004a) *Miralona* gen. n. – a new genus of the subfamily Aloninae (Anomopoda, Chydoridae) from Australia. *Hydrobiologia*, 526, 3–14.  
<http://dx.doi.org/10.1023/b:hydr.0000041619.35211.4a>
- Sinev, A.Y. (2004b) Redescription of two species of the genus *Leydigopsis* Sars, 1901 (Branchiopoda, Anomopoda, Chydoridae). *Invertebrate zoology*, 1 (1), 75–92.
- Sinev, A.Y. (2009) Notes on morphology and taxonomic status of some North American species of the genus *Alona* Baird, 1843 (Cladocera: Anomopoda: Chydoridae). *Fundamental and Applied Limnology*, 175 (1), 59–77.  
<http://dx.doi.org/10.1127/1863-9135/2009/0175-0059>
- Sinev, A.Y. (2013) Cladocerans of *Alona affinis* group (Cladocera: Anomopoda: Chydoridae) from North America. *Zootaxa*, 3693 (3), 329–343.  
<http://dx.doi.org/10.11646/zootaxa.3693.3.3>
- Sinev, A.Y. & Atroschenko, M.M. (2011) Revision of the genus *Alonopsis* Sars, 1862 and its position within Aloninae (Cladocera: Anomopoda: Chydoridae). *Zootaxa*, 2800, 1–17.
- Sinev, A.Y. & Silva-Briano, M. (2012) Cladocerans of genus *Alona* Baird, 1843 (Cladocera: Anomopoda: Chydoridae) and related genera from Aguascalientes State, Mexico. *Zootaxa*, 3569, 1–24.
- Sinev, A.Y. & Zawisza, E. (2013) Comments on cladocerans of crater lakes of the Nevado de Toluca Volcano (Central Mexico), with the description of a new species, *Alona manueli* sp. nov. *Zootaxa*, 3647 (2), 390–400.  
<http://dx.doi.org/10.11646/zootaxa.3647.2.10>
- Smirnov, N.N. (1971) *Chydoridae fauny mira. Fauna USSR. Rakoobraznie, 1*. Leningrad, 531 pp. [English translation: *Chydoridae of the world*. Israel Program for Scientific Translations, Jerusalem, 1974]
- Smirnov, N.N. (1996) *Cladocera: the Chydorinae and Sayciinae (Chydoridae) of the World. Guides to the identification of the microinvertebrates of the continental waters of the world 11*. SPB Academy Publishing, Amsterdam, 197 pp.
- Smirnov, N.N. & Kotov, A.A. (2010) The morphological radiation of setae of the Cladocera (Crustacea) and their potential for morphogenesis. *International Revue of Hydrobiology*, 95, 482–519.  
<http://dx.doi.org/10.1002/iroh.201011244>
- Šrámek-Hušek, R., Strašcraba, M. & Brtek, J. (1962) Lupenonožci-Branchiopoda. *Fauna ČSSR, Praha*, 16, 1–472.
- Streletskaia, E.A. (1975) Spisok kolovratok, vetvistousykh i veslonogikh rakoobraznykh vodoemov basseinov Kolymy i Anadyr' // *Gidrobiologicheskie issledovaniya vnutrennikh vodoemov Severo-Vostoka SSSR*. Vladivostok, 28 pp. [pp. 32–59, in Russian]
- Streletskaia, E.A. (2010) Review of the fauna of Rotatoria, Cladocera, and Copepoda of the basin of the Anadyr' River. *Contemporary Problems of Ecology*, 3 (4), 469–480.  
<http://dx.doi.org/10.1134/s1995425510040119>
- Sweetman, J.N. & Smol, J.P. (2006) Patterns in the distribution of cladocerans (Crustacea: Branchiopoda) in lakes across a north-south transect in Alaska, USA. *Hydrobiologia*, 553, 277–291.  
<http://dx.doi.org/10.1007/s10750-005-1333-8>
- Tanaka, S. (1989) Occurrence of littoral Chydoridae (Crustacea, Cladocera) in Japan. *Memoirs of the Faculty of Education Toyama University, Series B, Natural Sciences*, 37, 1–13.
- Tash, J.C. (1971) Some crustacean zooplankton of the Noatak River area, northern Alaska. *Arctic*, 24 (2), 108–112.  
<http://dx.doi.org/10.14430/arctic3120>
- Van Damme, K. & Sinev, A.Y. (2013) Tropical Amphi-Pacific disjunctions in the Cladocera (Crustacea: Branchiopoda). *Journal of Limnology*, 70 (2), 209–244.  
<http://dx.doi.org/10.4081/jlimnol.2013.s2.e11>
- Yoon, S.M. (2010) Arthropoda: Branchiopoda: Anostraca, Notostraca, Spinicaudata, Laevicaudata, Ctenopoda, Anomopoda, Haplopoda Branchiopods. *Invertebrate fauna of Korea*, 21 (2), 1–156.
- Xu, S., Hebert, P.D.N., Kotov, A.A. & Cristescu, M.E. (2009) The non-cosmopolitanism paradigm of freshwater zooplankton: insights from the global phylogeography of the predatory cladoceran *Polyphemus pediculus* (Crustacea, Onychopoda). *Molecular Ecology*, 18 (24), 5161–5179.  
<http://dx.doi.org/10.1111/j.1365-294x.2009.04422.x>