

Distribution and polymorphism of *Alona rectangula* Sars, 1862
(Branchiopoda: Anomopoda: Chydoridae)
in Russia and surrounding countries

Распространение и полиморфизм *Alona rectangula* Sars, 1862
(Branchiopoda: Anomopoda: Chydoridae)
в России и сопредельных странах

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КЛЮЧЕВЫЕ СЛОВА: ветвистоусые раки, распространение, полиморфизм скульптуры створок, разновидности.

ABSTRACT: Study of abundant material of *Alona rectangula* Sars, 1862 from different parts of Russia and surrounding countries reveals that all these populations completely agree with the revised detailed description of this species [Frey, 1988]. *A. rectangula* s.str. is distributed all over the territory of Russia. Specimens of *A. rectangula* with valve sculpturing combining longitudinal striae and tubercles are reported for the first time. Presence of such specimens suggests that the forms of *A. rectangula* with tuberculated valves and with valves covered by longitudinal striae cannot be treated as separate subspecies.

РЕЗЮМЕ: Изучение обширного материала по *Alona rectangula* Sars, 1862 из различных регионов России выявило, что все исследованные популяции отвечают полученному во время последней ревизии детальному описанию вида. *A. rectangula* s.str. обитает на всей территории России. Впервые были обнаружены экземпляры, скульптура створок комбинировала бугорки и продольную исчерченность. Это показывает что форма с бугорчатыми створками и форма со створками, покрытыми продольными линиями, не могут рассматриваться как отдельные подвиды.

Introduction

Alona rectangula Sars, 1862 is one of most frequently reported species of *Alona*, treated as a polymorphic cosmopolitan species by most authors [see Smirnov, 1971]. It was presumed that this species is distributed all over Russia [Bening, 1941; Manuilova, 1964; Smirnov, 1971]. However, in a revision of *A. rectangula* [Frey, 1988] showed that there are several related species

within the *rectangula*-group, with *A. rectangula* s. str. a well-differentiated, not very polymorphic species. Present records of occurrences of *A. rectangula* in Russia are not detailed enough to determine if they refer to *A. rectangula* s.str. or to some closely related species. The aim of the present research was to compare the material of *A. rectangula* from different parts of Russia with the data of Frey's revision.

Material and Methods

Animals were selected from samples under a binocular stereoscopic microscope, placed on slides (in a drop of a glycerol-formaldehyde mixture) and studied under the optical microscope entire. Several specimens from each sample were dissected for analysis of appendages. 14 specimens with unusual sculpturing of valves 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. The following samples were studied:

Material from Russia:

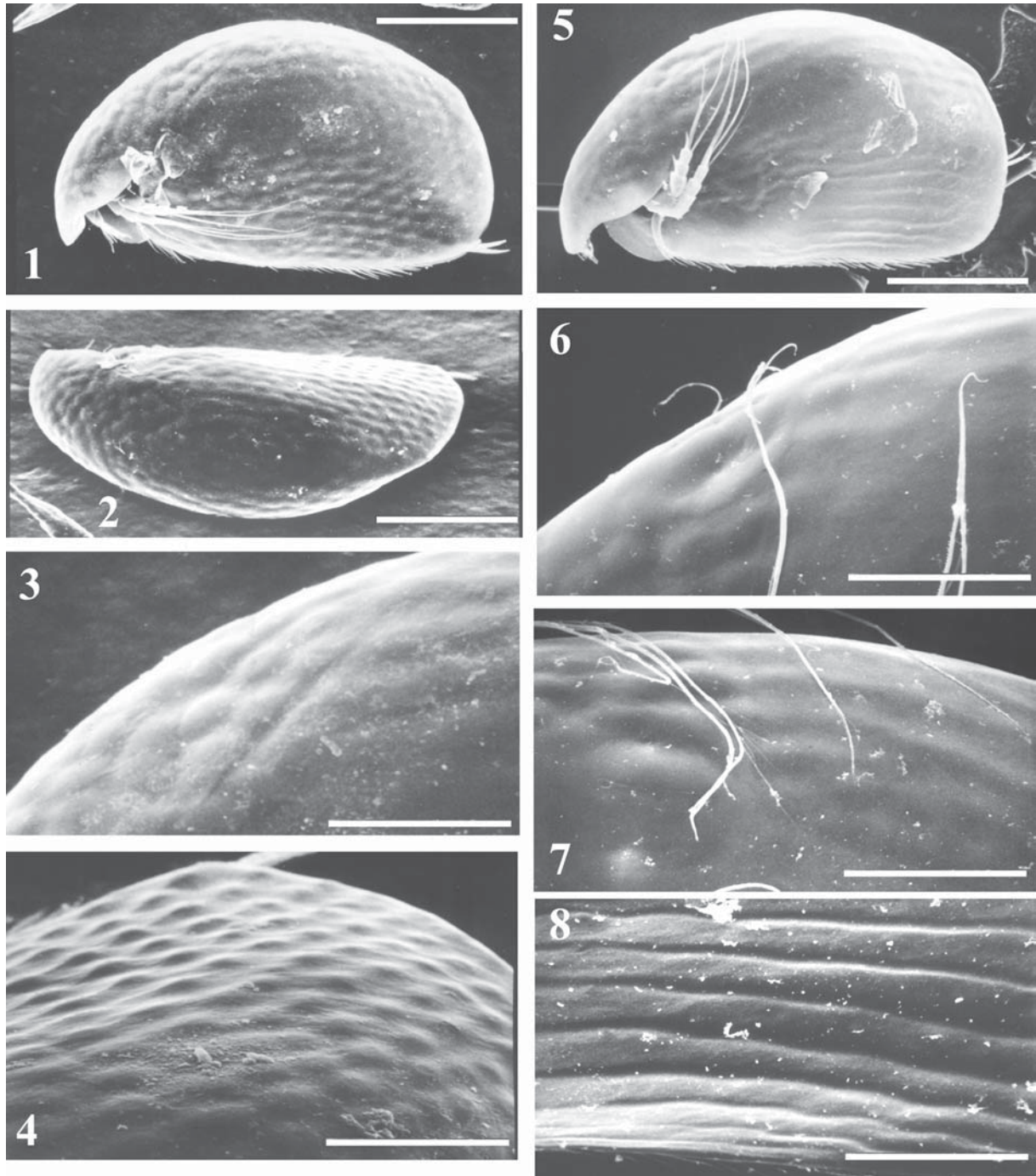
6 parthenogenetic females from Murmansk Area, lake on Kovda River, VII.1997, leg D.D. Sokoloff;

over 50 parthenogenetic females, 16 ephippial females, 5 males, 3 juvenile males of instar II from Karelia Republic, White Sea [Belomorskaya] Biological Station of Moscow State University, Nizhnee Ershovskoe Lake, VIII–IX.1996, leg. E.I. Izvekova, A.Yu. Sinev;

87 parthenogenetic females, including 23 females with intermediate type of sculpture on valves from Komi Republic, Vychegda River, 15.VIII.1966, leg. V.K. Izyurova;

22 parthenogenetic females, ephippial female, 7 males, 3 juvenile males of instar II, juvenile male of instar I from Yaroslavl Area, Nero Lake, 15.IX.1987, from N.N. Smirnov's collection;

parthenogenetic female, 3 ephippial females, male from Moscow Area, Moscow, Solntsevo, pond near Borovskoe Shosse Street, 3.X.1998, leg. S.I. Ljovuschkin;



Figs 1–8. *Alona rectangula* Sars, 1962. 1–4: from Russia, Irkutsk Area, the lake from which the Lena River begins, with tuberculated sculpturing of head shield and valves, parthenogenetic female; 5–8: from Russia, Komi Republic, Vychegda River, 15.VIII.1966, with intermediate type of sculpturing of head shield and valves, parthenogenetic female: 1, 5 — lateral view, 2 — dorso-lateral view, 3, 6 — sculpturing of head shield, lateral view, 4 — sculpturing of valves, dorso-lateral view, 7 — sculpturing of head shield, dorso-lateral view, 8 — sculpturing of valves, lateral view. Scale bar: 0.1 mm (1, 2, 5), 0.05 mm (3, 4, 6–8).

Рис. 1–8. *Alona rectangula* Sars, 1962. 1–4: Россия, Иркутская область, озеро, являющееся истоком реки Лена, с бугорчатыми створками и головным щитом, партеногенетическая самка; 5–8: то же, Россия, Республика Коми, река Вычегда, 15.VIII.1966, с переходным типом скульптуры створок и головного щита, партеногенетическая самка: 1, 5 — вид сбоку, 2 — вид со спинной стороны, 3, 6 — скульптура головного щита, вид сбоку, 4 — скульптура створок, вид со спинной стороны, 7 — скульптура головного щита, вид со спинной стороны, 8 — скульптура створок, вид сбоку. Масштаб — 0,1 мм (1, 2, 5), 0,05 мм (3, 4, 6–8).

6 parthenogenetic females, male from Moscow Area, Moscow, Tekstilshchiki Distr., Sadki pond, 14.X.2000, leg. A.Yu. Sinev;

2 parthenogenetic females, ehippial female, 2 males from Moscow Area, Gzhel, water body in sand-pit of Gzhel brick manufacture, 26.IX.1998, leg. D.G. Zhadan;

17 parthenogenetic females, from Saratov Area, Saratov, pond near 9th Dachnaya Street, 6.IX.1998, leg. E.E. Morozova, and male from same location, 20.X.1998;

10 parthenogenetic females, 8 ehippial female, 3 males from Russia, 3 juvenile males of instar II from Astrakhan Area, Volga River avant-delta, no date, leg. A.A. Kosova;

over 40 parthenogenetic females, from Stavropol Province, Nevinnomyssk, pond near Nevinskaya Mt., 3.IX.1999, leg. A.O. Lysenko;

4 parthenogenetic females with tuberculated valves, from Irkutsk Area, the lake from which the Lena River begins, no date, leg. N.G. Sheveleva;

10 parthenogenetic females, male from Chita Area, Chita, Kenon Lake, 10.IX.1971, leg. N.N. Smirnov;

2 parthenogenetic females with tuberculated valves from Taimyr Area, water body on the coast of the Khatanga River near Khatanga, 27.07.2000, leg. E.V. Rakhimberdiev;

5 parthenogenetic females from Sakha-Yakutia Republic, Yakutsk, Sergelyakhscoe Lake, 8.VIII.1998, leg. M.V. Kim;

over 100 parthenogenetic and ehippial females, over 50 males from Primorie Province, Nakhodka Distr., pond in Avangard Village, 13.X.1999, leg. E.N. Temereva.

Material from other countries:

3 parthenogenetic females from Poland, delta of the Vistula River, Druzno Lake, no date, from N.N. Smirnov collection.

16 parthenogenetic females, 5 ehippial females, 4 males, 1 juvenile male of instar II from South-East Poland, Siget, leg. W. Jurass, 20 10 89

2 parthenogenetic females from Kazakhstan, Kurtinskoe Reservoir, VI.2000, leg. E.G. Krupa;

47 parthenogenetic females from Uzbekistan, Tashkent Area, pond of Kalgan-Chirgik fishery, 22.VII.1961, leg. N.N. Smirnov;

2 parthenogenetic females from Mongolia, water body on the coast of the Tola River, 28.VII. 1999, leg V.R. Alekseev.

Results

Specimens from all listed locations agreed with Frey's [1988] redescription of *Alona rectangula*, and with other recent description of this species [Negrea, 1983; Alonso, 1996].

Study of tuberculated specimens with the scanning electron microscope shows, that all the surface of valves and head shield is covered by similar, more or less evenly distributed tubercles, about 0.01 mm in diameter (Figs 1–4). Study of appendages and postabdomens of the tuberculated specimens shows that unlike specimens reported by Smirnov [1997] which have more numerous marginal denticles than typical form, studied specimens do not differ from the typical form in any other characters other that sculpturing of valves and head shield.

Specimens with the intermediate type of sculpturing on head shield and valves were found in one location (Komi Republic, Vychegda River) in the sample together with the specimens with typical sculpturing. Such specimens (Fig. 5) have the head shield and dorsal part of the valves covered by tubercles, but the usual longitudinal striae were present in the postero-ventral part of the valves. In these specimens, tubercles (Figs 6–7) are

of the same diameter as in completely tuberculated specimens, about 0.01 mm, and similarly spaced, but somewhat less developed. Longitudinal striae of such specimens (Fig. 8) are the same as in the typical specimens [Frey, 1988]. The share of the specimens with intermediate type of sculpturing in the sample was about 25% of the population (23 specimens from 87 total), including both juvenile individuals of both instars and adults. Study of appendages and postabdomens of these specimens reveals that they do not differ from the rest of population in other characters.

Discussion

Our data confirm the opinion of Manuilova [1964] and Smirnov [1971] that *A. rectangula* s. str. inhabits all the territory of Russia. Our material includes specimens from arctic, temperate and subtropical regions, from East Siberia and Far East of our country. The distribution of *A. rectangula* seems to be similar to that of the other widely distributed *Alona* of the Old World, such as *A. affinis* (Leydig, 1860) [Sinev, 1998] and *A. costata* Sars, 1862 [Sinev, 2000]. These species are distributed from West and South Europe to Far East Asia, and their variability in temperate regions is rather small. As for the aforementioned species, the taxonomic status of most tropical occurrences of *A. rectangula* reported before Frey's revision [1988], remains unclear. According to Frey [1988], *A. rectangula* s.str. is not present in North America.

The number of the synonyms, subspecies and varieties of *A. rectangula* among the Chydoridae is surpassed only by those of *Chydorus sphaericus* (O.F. Müller, 1875). Smirnov [1971] listed 7 subspecies, and more than 10 synonyms, of *A. rectangula*. He treated *A. elegans* Kurz, 1875 as a subspecies of *A. rectangula*, and added to the list *A. rectangula serrata* Daday, 1908 which is a separate taxon not even closely related to *A. rectangula*. While the criteria for separation of the three other subspecies, *A. rectangula richardi* Stingelin, 1895, *A. rectangula coronata* Kurz, 1875, and *A. rectangula novae-zealandiae* [Sars, 1904], from the nominate species are vague and uncertain, the tuberculated form, *A. rectangula pulchra* Hellich, 1874 is clearly differentiated from the nominate form by the sculpturing of the valves, and was treated as a separate species by early authors [Hellich, 1874; Matile, 1890; Stingelin, 1895]. While the tuberculated forms of *A. guttata* Sars, 1862, *A. verrucosa* Sars, 1901 and *A. rustica* Scott, 1875 were frequently noted, the tuberculated *A. rectangula* was doubted until recently, when Smirnov [1997] confirmed it as a rare form. Our material reconfirms the existence of this form.

Specimens with an intermediate valve sculpturing have not been recorded previously for *A. rectangula*, or for other species of *Alona* including forms with linear and tuberculated sculpturing such as *A. rustica*, *A. guttata* and *A. verrucosa*. Presence of the intermediate form suggests that tuberculated and striated form of *A. rectan-*

gula cannot be treated as subspecies and should be regarded as varieties, viz. *A. rectangula* var. *rectangula*, and *A. rectangula* var. *pulchra*.

There is no evidence of the presence of other species of the *rectangula*-group in Russia, however the cladoceran fauna of Siberia and Far East of Russia is poorly studied, and discovery of other species of the *rectangula*-group is possible, especially in the Far East.

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