

Notes on Aloninae Dybowski & Grochowski, 1894 *emend.* Frey, 1967
(Cladocera: Anomopoda: Chydoridae):
4. On the phylogeny of four genera

Заметки о подсемействе Aloninae Dybowski & Grochowski, 1894
emend. Frey, 1967 (Cladocera: Anomopoda: Chydoridae):
4. Филогения четырех родов

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КЛЮЧЕВЫЕ СЛОВА: Cladocera, Anomopoda, Chydoridae, Aloninae, морфология, систематика, филогения, кладистика.

ABSTRACT. A cladistic study of phylogeny was performed for four genera of the Aloninae (Cladocera: Anomopoda: Chydoridae) (*Karualona*, *Kozhowia*, *Kurzia* and *Nicsmirnovius*) using accessible literature data. The relationships between all known species within each genus are discussed. The boundary between the subgenera *Kurzia* (*Kurzia*) Dybowski & Grochowski, 1894 and *Kurzia* (*Rostrokurzia*) Hudec, 2000 does not follow the boundary between two main clades within the genus. This anomaly was improved by relocating *K. media* (Birge, 1879) into the subgenus *K. (Rostrokurzia)*. *Alona longirostris* Daday, 1898 (= *K. longirostris*) is designated as the type species of the subgenus *K. (Rostrokurzia)* *emend. nov.* Emended diagnoses of two subgenera of *Kurzia* are provided. The patterns of inter-continental grouping of species are different for different genera.

РЕЗЮМЕ. Проведено кладиристическое исследование филогении четырех родов подсемейства Aloninae (Cladocera: Anomopoda: Chydoridae) (*Karualona*, *Kozhowia*, *Kurzia* и *Nicsmirnovius*) с использованием всех имеющихся литературных данных. Обсуждены родственные отношения между видами каждого из четырех родов. Разграничение подродов *Kurzia* (*Kurzia*) Dybowski & Grochowski, 1894 и *Kurzia* (*Rostrokurzia*) Hudec, 2000 по Гудецу [Hudec, 2000] не соответствует двум основным монофилетическим группам, выявленным внутри рода. Ситуация исправлена путем перемещения вида *K. media* (Birge, 1879) в подрод *K. (Rostrokurzia)*. В данной публикации *Alona longirostris* Daday, 1898 (= *K. longirostris*) выбрана как типовой вид подрода *Kurzia* (*Rostrokurzia*) *emend. nov.*, поскольку ранее Гудец [Hudec, 2000] не указал типовой вид для этого подрода. Для двух подродов рода *Kurzia* приве-

дены переработанные диагнозы. Для разных родов выявлены различные типы родственных связей между видами с разных континентов.

Introduction

Among numerous representatives of the subfamily Aloninae Dybowski & Grochowski, 1894 *emend.* Frey, 1967, there are some genera which have not been revised since Smirnov's [1971] monograph, e.g. *Acroperus* Baird, 1843 and *Leydigopsis* Sars, 1901. The most problematic genus is *Alona* Baird, 1843. Subsequent to Smirnov's [1971] monograph, several species of *Alona* have been separated from the bulk of this genus to create new genera (e.g. *Nicsmirnovius* Chiambeng & Dumont, 1999 and *Karualona* Dumont & Silva-Briano, 2000) based on different diagnostic features. As a result, current ideas on the diagnosis of *Alona* are very dubious, indeed have not been formulated since Smirnov [1971].

In contrast, significant recent progress has been made for some other genera, e.g. *Karualona* [Dumont & Silva-Briano, 2000]; *Kurzia* [Hudec, 2000]; *Kozhowia* [Kotov, 2000]; *Nicsmirnovius* [Chiambeng & Dumont, 1999; Van Damme et al., 2003; Kotov & Sanoamuang, 2004]. Attempts to reconstruct inter-taxa phylogeny within each genus are few [Smirnov, 1971; Hudec, 2000; Kotov, 2000].

This article reports on a cladistic investigation of the phylogeny of alonine genera for which sufficient data exist at the present-day level of their study. The genera *Acroperus* and *Alona* are large and insufficiently studied, so it is very difficult to trace the relationships within them using any approaches. Although the genus *Camptocercus* Baird, 1843 was revised by Smirnov [1998],

information on some species (especially on limbs) is not detailed enough for phylogenetic reconstruction. Most alonine genera contain only 1–2 species, so were not included in the phylogenetic investigation. Among all alonines, I selected the following four genera for cladistic analysis: *Karualona* Dumont & Silva-Briano, 2000; *Kozhowia* Vasiljeva & Smirnov, 1969 emend Kotov, 2000; *Kurzia* Dybowski & Grochowski, 1984; and *Nic-smirnovius* Chiambeng & Dumont, 1999.

Material and Methods

Available published data on the morphology of different species were used. Cladistic analysis was performed by the PAUP program Vers. 4.0b10 for 32 bit Microsoft Windows [Swofford, 2000], using branch-and-bond search. Descriptions of analysed characters and data matrices are given in separate tables for each genus. A 50% majority rule bootstrap simulation of 100 replications was performed as a test of robustness of each analysis. SEM and light photographs were taken using methods described previously [e.g. Kotov, 2000; Kotov & Sanoamuang, 2004]. For each illustrated animal, the locality is reported in the figure caption.

ABBREVIATIONS. Collections: AAK — personal collection of A. A. Kotov, Moscow, Russia; NMK — collection of Dr N. M. Korovchinsky, now kept at Zoological Museum of Moscow State University (MGU); NNS — personal collection of Prof. N. N. Smirnov, now kept at MGU, but not officially deposited to it; NNS MGU — collection of slides of Prof. N. N. Smirnov, deposited to MGU.

Cladistic terminology: CI — consistency index; RI — retention index; TL — tree length.

Results and Discussion

1. Genus *Karualona* Dumont & Silva-Briano, 2000

HISTORY OF STUDY. *Alona karua* King, 1853 was relocated by Smirnov [1971] to the genus *Biapertura* Smirnov, 1971, and regarded as a tropicopolitan species. Subsequently Alonso & Pretus [1989] found a new *karua*-like species in Spain. Dumont & Brancelj [1994] described *Alona alsafadi* from Yemen, and said that this is a primitive member of the *A. karua*-group. More recently, a separate genus, *Karualona* Dumont & Silva-Briano, 2000 was constructed for the *karua*-group, and two new species were added to the genus, *K. penuelasi* from Mexico and *K. socotrana* from Socotra. Sinev & Hollwedel [2004] redescribed the neglected *K. muelleri* (Richard, 1897) and attempted to analyse relationships within the genus *Karualona*, but their ideas do not seem to be justified.

OUTGROUPS AND MATRIX FORMATION. *Alona rigidicaudis* (Smirnov, 1971) and *A. dentifera* (Sars, 1901) were used as two outgroups. Among all *Alona*-like representatives of the Aloninae (sensu Kotov & Sanoamuang [2004]), their morphology is most similar

to that of *Karualona* (confirmed by Dr. A.Y. Sinev [personal communication]). These two species are distinctive among the “*Alona*” s. lat., and can be regarded as pretenders to be separated into discrete genera. Data of Van Damme *et al.* [2003], the description of *A. rigidicaudis* by Smirnov & Timms [1983].

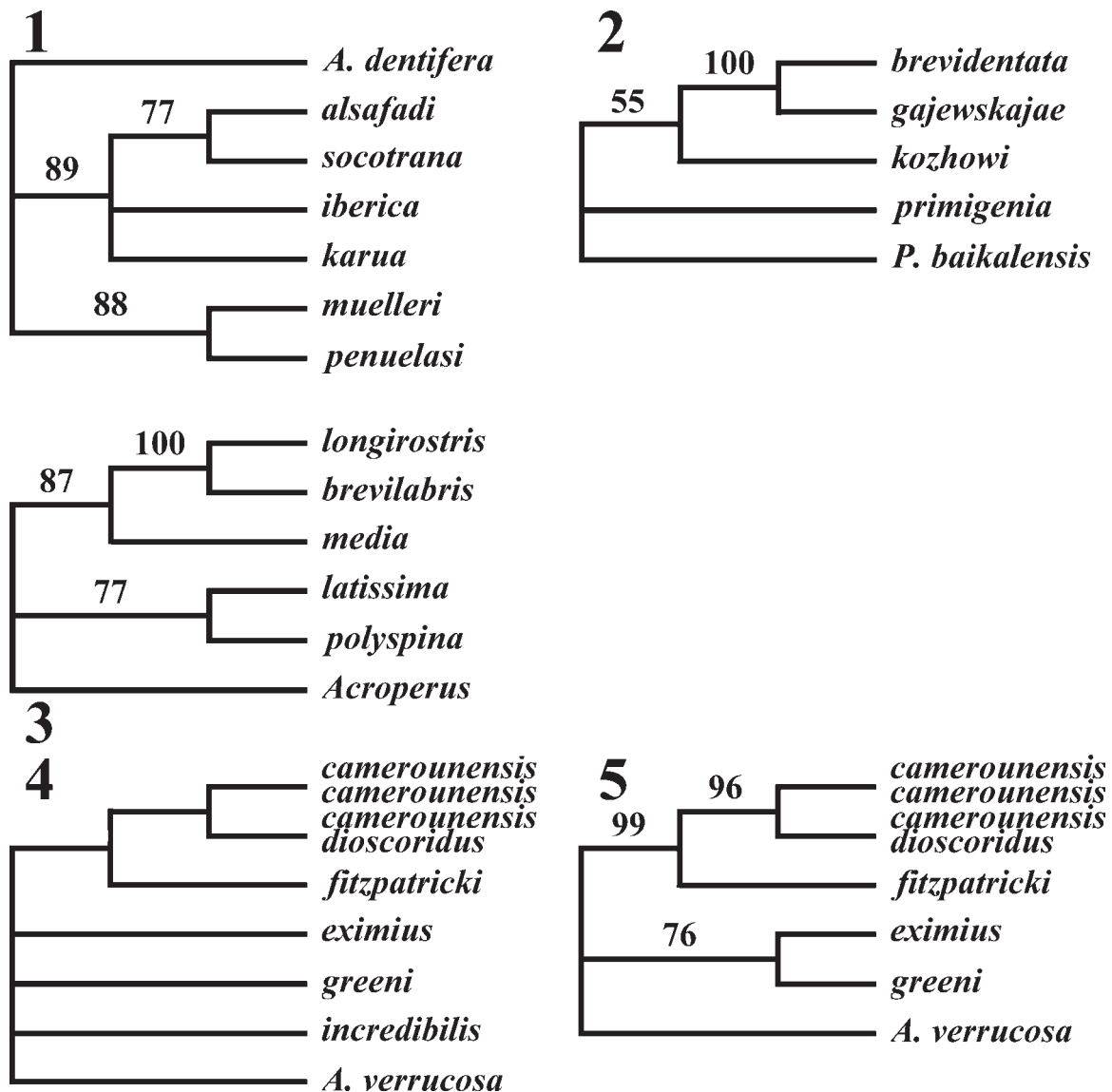
Character descriptions for *Karualona* as follows (p — present; a — absent):

1. Postpore distance more than 2 interpore distance (a = 0, p = 1);
2. Labral keel reduced in size (a = 0, p = 1);
3. Denticles at postero-dorsal region of valve large (a = 0, p = 1);
4. Basal spine on postabdominal claw long (0), small (1), reduced (2);
5. Postanal denticles robust and single (a = 0, p = 1);
6. In each fascicle of lateral setules the first member especially thick (a = 0, p = 1);
7. Lateral setules projected strongly behind dorsal margin of postabdomen (a = 0, p = 1);
8. Sensory seta of antenna I long (a = 0, p = 1);
9. Antenna II, spine on basal segment as long or longer than next segment (a = 0, p = 1);
10. Setules on ODL strong (a = 0, p = 1);
11. One among two IDL largest setae significantly longer than other one (a = 0, p = 1);
12. Setae on exopodite IV not differentiated in size (a = 0, p = 1).

Unpublished data on *A. dentifera* were used for the matrix preparation. Data matrix of 12 morphological characters used in cladistic analysis of *Karualona* as follows:

Taxon	1	2	3	4	5	6	7	8	9	10	11	12
<i>K. alsafadi</i>	1	1	0	2	0	1	0	0	1	0	1	1
<i>K. socotrana</i>	1	1	0	2	0	1	1	0	-	0	1	1
<i>K. karua</i>	1	1	0	1	0	1	1	1	1	0	1	0
<i>K. iberica</i>	0	1	0	1	0	1	1	1	1	0	1	0
<i>K. muelleri</i>	0	0	1	1	1	1	1	0	1	1	0	0
<i>K. penuelasi</i>	-	0	1	1	1	1	0	-	-	1	0	0
<i>Alona dentifera</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Alona rigidicaudis</i>	0	-	0	0	0	0	0	-	0	-	0	-

TREE DESCRIPTION. Each of three different variants of my analysis (using only *A. rigidicaudis*, or only *A. dentifera*, as an outgroup, or both taxa as two outgroups) with all characters unordered, yielded two most-parsimonious trees (TL = 16; with CI = 0.79, RI = 0.79 in the first variant; CI = 0.81, RI = 0.77 in the second variant; CI = 0.81, RI = 0.84 in the third variant). A strict consensus tree is represented in Fig. 1. Bootstrap test yielded (in each variant) a tree with topology exactly the same with aforementioned tree, with slightly different probabilities of branches in different variants (I



Figs 1–5. Reconstructions of phylogeny for four genera of the Aloninae: 1 — strict consensus of two most parsimonious trees for *Karualona* (50 % major rule tree has exactly the same topology, probability of each branch is represented on the same phylogram); 2 — a single most parsimonious tree for *Kozhowia*; 3 — a single most parsimonious tree for *Kurzia*; 4 — a strict consensus of four most parsimonious trees for *Nicsmirmovius*; 5 — a single most parsimonious tree obtained for this genus after exclusion of poorly studied *N. incredibilis* from the analysis.

Рис. 1–5. Реконструкция филогении четырех родов аленин: 1 — строгий консенсус двух наиболее экономных деревьев для *Karualona* (поскольку дерево, полученное в ходе “50 % major rule tree” теста было абсолютно той же топологии, вероятности для каждой ветви согласно этому тесту проставлены на той же филограмме); 2 — единственное наиболее экономное дерево для *Kozhowia*; 3 — единственное наиболее экономное дерево для *Kurzia*; 4 — строгий консенсус четырех наиболее экономных деревьев для *Nicsmirmovius*; 5 — единственное наиболее экономное дерево для этого рода, полученное после удаления из анализа плохо изученного *N. incredibilis*.

placed to the contree in Fig. 1 the probabilities of branches obtained in a variant of a search with *A. dentifera* as an outgroup).

There are two main clades within the genus *Karualona*: an American *muelleri*-complex, and a tropicopolitan *karua*-complex. The exact number of species within the latter is not clear; there is a significant chance that a series of *karua*-like species inhabits different tropical and sub-

tropical regions of the world (*karua*-like species are present in the New World also [Kotov, unpublished]). Among them, only three species are well-described, *K. iberica* known from Spain to Senegal [Dumont & Silva-Briano, 2000], and two members of a well-defined regional “Arabian” group of species: groundwater-dwelling *K. alsafadi* known only from Yemen, and *K. socotrana*, known only from Socotra Island.

DISCUSSION. Dumont & Silva-Briano [2000] correctly concluded that *K. alsafadi* is a relative of *K. socotrana*. These two species compose the regional “Arabian” group of the tropicopolitan *karua*-complex. I think the relationship of these two species with restricted areals is a reflection of a relationship between faunas of the Arabian Peninsula and Socotra Island. The presumption of a primitive status of *K. alsafadi* by Dumont & Brancelj [1994] is not confirmed here. The close affinity of *K. muelleri* and *K. penuelasi* revealed by Sinev & Hollwedel [2003] is confirmed here; just these two species compose the “American” group.

The tropicopolitan *K. karua*-complex is the main subject for further investigations. My phylogenetic tree is not a pretender to be a “final” construction, it is a reflection of recent state of the knowledge’s on the genus morphology and systematics. But I hope, that the tree can be helpful for further investigation of the genus *Karualona*.

2. Genus *Kozhowia* Vasiljeva & Smirnov, 1969 emend. Kotov, 2000

HISTORY OF STUDY. Vasiljeva & Smirnov [1969] described four species of a newly established genus, *Kozhowia*, from Lake Baikal: *K. kozhowi*, *K. primigenia*, *K. gajewskajae*, and *K. baikalensis*. Three years later a fifth species, *K. brevidentata* Vasiljeva & Smirnov, 1971 was proposed (in Smirnov [1971]). Kotov [2000] redescribed all species, and separated a single species, *P. baikalensis* (Vasiljeva & Smirnov, 1969), into a new genus *Parakozhowia* Kotov, 2000.

OUTGROUP AND MATRIX FORMATION. *Parakozhowia*, with a single species *P. baikalensis* (Vasiljeva & Smirnov, 1969), is the clearly defined sister group of *Kozhowia* [Kotov, 2000], and just *Parakozhowia* was used as the outgroup.

Character descriptions for *Kozhowia* as follows (p — present; a — absent):

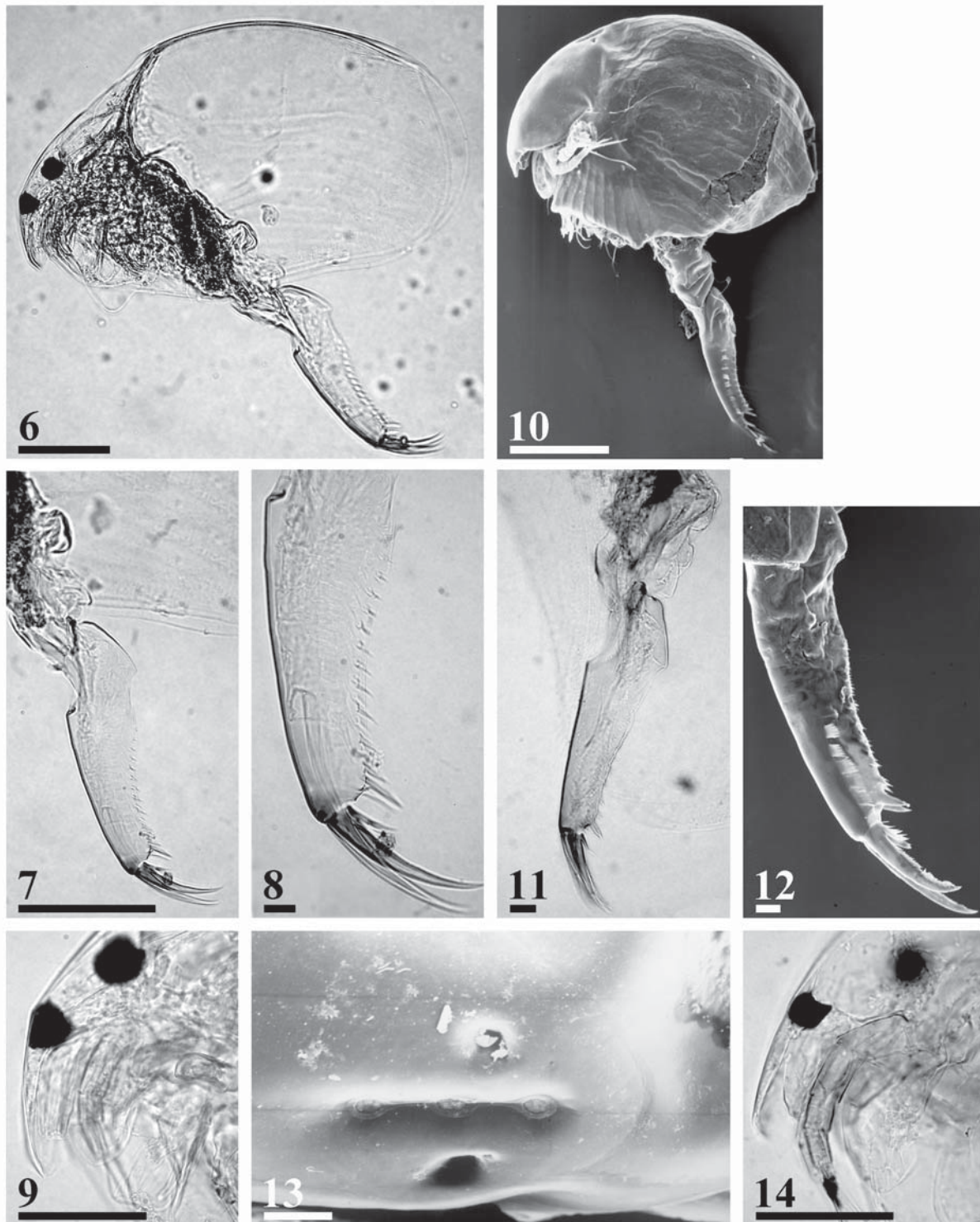
1. Distance between lateral pores more than distance between marginal major pores (a = 0, p = 1);
2. Lateral pores posteriorly to middle major pore (a = 0, p = 1);
3. Number of marginal setae large (a = 0, p = 1);
4. Postabdomen specially elongated (a = 0, p = 1);
5. General number of postanal denticles or their clusters up to 11 (0) 11–14 (1) 15 and more (2);
6. Base of postabdominal claw narrow (a = 0, p = 1);
7. Basal spine far from claw base (a = 0, p = 1);
8. Basal spine compressed to claw (a = 0, p = 1);
9. Antenna I long and thin (a = 0, p = 1);
10. Spine on the first segment of antennal rudimentary (a = 0, p = 1);
11. Hook-like seta on IDL (a = 0, p = 1);
12. Denticles on setae 3 and 6 of limb II of similar size (a = 0, p = 1);
13. Second seta on exopodite IV (counting from distal angle) rudimentary (a = 0, p = 1);
14. Sensillum on border of gnathobase IV globular (a = 0, p = 1).

The matrix was constructed based predominantly on Table 1 in Kotov [2000], but the characters subjective for phylogeny, or unique peculiarities of *Parakozhowia*, were removed. Note that polarization of character 12 was conducted according to the outgroup, but is in contradiction with my personal view on the group’s evolution. Data matrix of 14 morphological characters used in cladistic analysis of *Kozhowia* as follows:

Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>K. kozhowi</i>	0	1	0	0	1	0	0	0	0	0	0	0	1	1
<i>K. primigenia</i>	1	1	0	0	1	0	0	0	0	0	0	1	0	0
<i>K. brevidentata</i>	1	0	1	1	2	1	1	1	1	1	1	0	1	1
<i>K. gajewskajae</i>	1	0	1	1	2	1	1	1	1	1	1	1	1	1
<i>P. baikalensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0

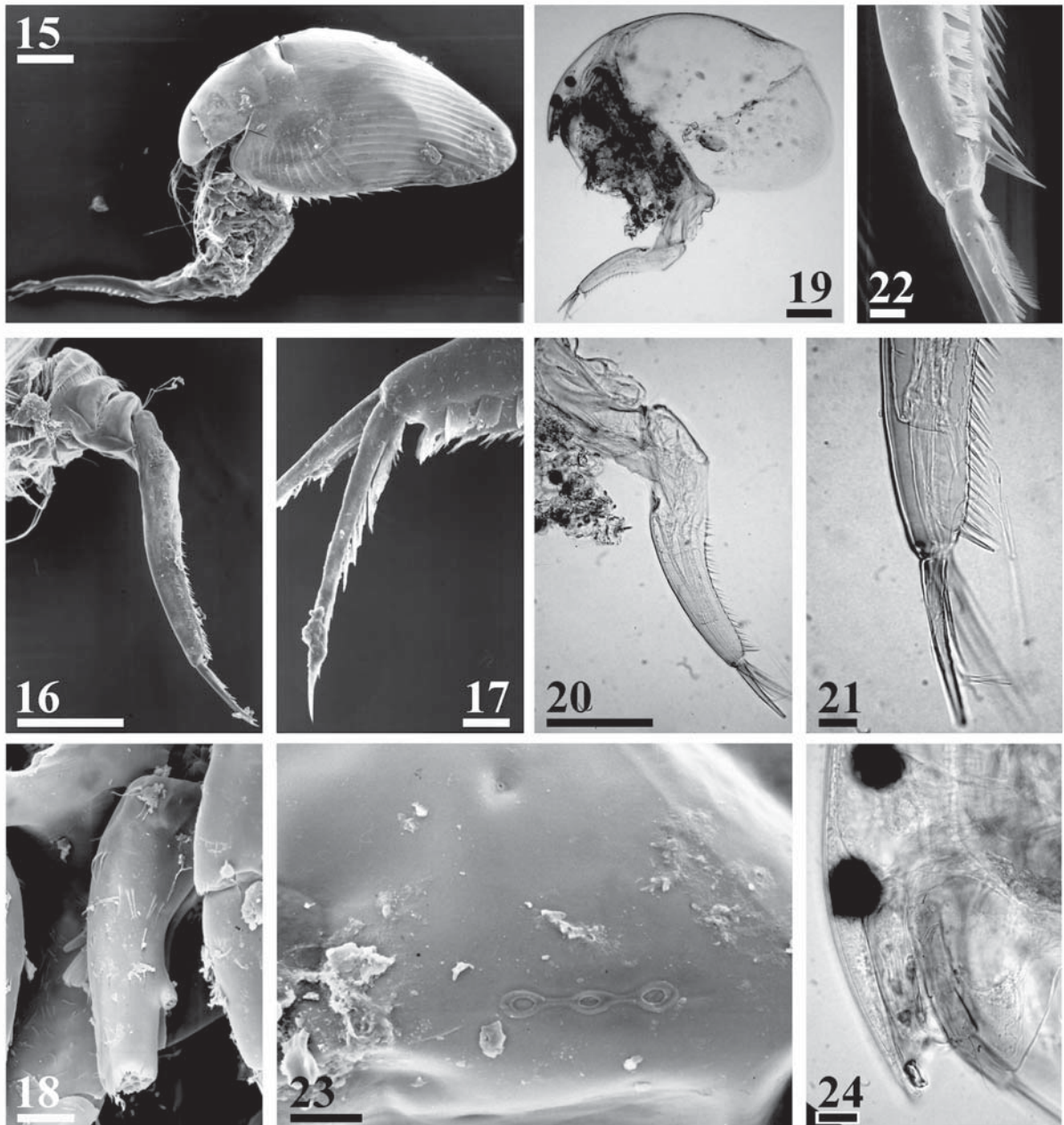
TREE DESCRIPTION. My analysis with all characters unordered yielded a single highly parsimonious tree (TL = 19, CI = 0.84, RI = 0.79). The same tree was obtained after the polarisation of multistate characters 5 and 9. The 50% majority rule bootstrap simulation gave a tree of exactly the same topology. The tree is asymmetrical, without any grouping of species (Fig. 2). The most primitive species is *P. primigenia*.

DISCUSSION. Previously Kotov [2000] gave a preliminary opinion on the phylogeny of *Kozhowia*, and noted that two species groups were evident within the genus: *K. kozhowi* + *K. primigenia* and *K. brevidentata* + *K. gajewskajae* (no taxa were constructed for the groups). The following traits are characteristic for the second group, in contrast to the first group: “(1) larger size; (2) body, more compressed laterally; (3) more numerous marginal setae on valve; (4) greater ratio of postabdomen length/height; (5) more numerous postanal marginal denticles, (6) thin basal spine of postabdominal claw, pressed against the claw; (7) rare setules in the first pecten on the postabdominal claw; (8) hook-like greatest seta on IDL” [Kotov, 2000: 55]. The cladistic search revealed that my preliminary opinion was not accurate, and I was justified in not proposing any subgenera for these groups. Indeed, the grouping of *K. brevidentata* + *K. gajewskajae* is well-justified by the analysis (as two terminal taxa of the tree), while the second “group” is paraphyletic. Apparently *K. primigenia* (Figs 6–9) and *K. kozhowi* (Figs 10–14) are two more primitive members of the genus, which cannot be grouped together. All 8 above-listed characters from the diagnosis of the first group, *K. brevidentata* (Figs 15–18) plus *K. gajewskajae* (Figs 19–24), are synapomorphies. In contrast, preliminary grouping of *K. primigenia* plus *K. kozhowi* was based exclusively on set of synplesiomorphies. I agree with the opinion that a set of synplesiomorphies for any taxa is not a good reason for their grouping, and, in particular, for any taxonomic constructions. So, *Kozhowia* cannot be subdivided into any subgenera.



Figs 6–14. Parthenogenetic ♀ of *Kozhowia primigenia* from region of Bolshie Koty, holotype NNS MGU 2260 (6–9), and *Kozhowia kozhowi* from Davsha Bay, from tube NNS 1998-202 (10–14), Lake Baikal, Asian Russia: 6, 10 — lateral view; 7, 8, 11, 12 — postabdomen; 9, 14 — head in lateral view; 13 — head pores. Scales: 6, 7, 9, 10, 14 — 100 μ m; 8, 11–13 — 10 μ m.

Рис. 6–14. Партегенетическая ♀ *Kozhowia primigenia* из района Больших Котов, голотип, препарат NNS MGU 2260 (6–9), и *Kozhowia kozhowi* из бухты Давша, из пробы NNS 1998-202 (10–14), Байкал, Россия: 6, 10 — вид сбоку; 7, 8, 11, 12 — постабдомен; 9, 14 — голова сбоку; 13 — головные поры. Масштаб: 6, 7, 9, 10, 14 — 100 мкм; 8, 11–13 — 10 мкм.



Figs 15–24. Parthenogenetic ♀ of *Kozhowia brevidentata* from region of Malie Koty, tube NNS 1998-206 (15–18), and *Kozhowia gajewskajae* from Davsha Bay, tube NNS 1998-202, (19–23), Lake Baikal, Asian Russia: 15, 19 — lateral view; 16, 17, 20–22 — postabdomen; 18 — antenna I; 23 — head pores; 24 — head in lateral view. Scales: 15, 16, 19, 20 — 100 μ m; 17, 18, 21–24 — 10 μ m.

Рис. 15–24. Парthenогенетическая ♀ *Kozhowia brevidentata* из района Малых Котов, из пробы NNS 1998-206 (15–18), и *Kozhowia gajewskajae* из бухты Давша, из пробы NNS 1998-202 (19–23), Байкал, Россия: 15, 19 — вид сбоку; 16, 17, 20–22 — постабдомен; 18 — антенна I; 23 — головные поры; 24 — голова сбоку. Масштаб: 15, 16, 19, 20 — 100 мкм; 17, 18, 21–24 — 10 мкм.

Within *Kozhowia*, evolution progressed through further lateral compression of the body, elongation of the postabdomen, and a shift of the lateral pores from the midline, in parallel with analogous evolution within two closely related genera, *Acroperus* and *Camptocercus* [Smirnov, 1971, 1998].

The genus *Kozhowia* is an endemic of Baikal, penetrating only the closest man-made Irkutsk Reservoir [Vasiljeva & Smirnov, 1978], which after the construction of a dam of Irkutsk Power Station became, in fact, a gulf of Baikal [Kozhow, 1962]. It seems that no more species of this genus will be found, so, the genus is among the best studied within the subfamily, and within the whole order Anomopoda.

3. Genus *Kurzia* Dybowski & Grochowski, 1894

HISTORY OF STUDY. When Dybowski & Grochowski [1894] established a new genus *Kurzia*, they listed two species: *Alonopsis latissima* Kurz and a new species *Kurzia polonica*. The latter species was redescribed later [Dybowski & Grochowski, 1898], but no one character significant for discrimination from *K. latissima* was listed. Daday [1898] found a distinctive species, *K. longirostris*, in Ceylon. Rajapaksa & Fernando [1986] re-studied *K. longirostris* and described *K. brevilabris* from tropical Asia. Hudec [2000] suggested a subdivision of the genus into two subgenera: (1) *Kurzia* (*Kurzia*), with three species: *K. latissima* Kurz, 1874, *K. cf. media* Birge, 1879 and *K. polyspina* Hudec, 2000 and (2) *Kurzia* (*Rostrokurzia*) with two species: *K. longirostris* Daday, 1898 and *K. brevilabris* Rajapaksa & Fernando, 1986.

OUTGROUP AND MATRIX FORMATION. Among alonines with a long postabdomen and three major head pores, I selected as an outgroup for this analysis *Acroperus*, a less specialised genus compared to *Camptocercus*, *Kozhowia* or *Parakozhowia*. Data by Rajapaksa & Fernando [1986] and Hudec [2000] were used in the description and for the matrix preparation.

Character descriptions for *Kurzia* as follows (p — present; a — absent):

1. First and third major head pores larger than median pore (a = 0, p = 1);
2. Rostrum particularly long (a = 0, p = 1);
3. Setules on posterior margin of valve rough (a = 0, p = 1);
4. Postabdomen with deeply concave dorsal margin (a = 0, p = 1);
5. Dorso-distal angle of postabdomen projected (a = 0, p = 1);
6. Presence of robust postanal teeth (a = 0, p = 1);
7. Basal spine normal (0), shortened (as claw thickness) (1), very thin (2);
8. Setae of IDL with spines (a = 0, p = 1);
9. Exopodite III with elongated seta fourth seta (as counted from distal corner) (a = 0, p = 1);
10. Exopodite IV with setae of similar size (a = 0, p = 1);

11. Male postabdomen significantly narrowing distally (a = 0, p = 1).

Data matrix of 11 morphological characters used in cladistic analysis of *Kurzia* as follows:

Taxon	1	2	3	4	5	6	7	8	9	10	11
<i>K. latissima</i>	0	0	0	0	0	0	2	0	1	0	0
<i>K. polyspina</i>	0	0	0	0	0	0	2	1	1	0	0
<i>K. media</i>	0	0	0	1	1	1	0	0	-	0	0
<i>K. longirostris</i>	1	1	1	1	1	1	1	1	0	1	1
<i>K. brevilabris</i>	1	1	1	1	1	1	1	1	0	1	1
<i>Acroperus</i>	0	0	0	0	0	0	0	-	0	0	0

TREE DESCRIPTION. My analysis with all characters unordered yielded a single highly parsimonious tree (TL = 13, CI = 0.92, RI = 0.93). The 50% majority rule bootstrap simulation led to a tree of exactly the same topology. There are two main clades within the genus *Kurzia*: a “*latissima*”-group, and a “*longirostris*”-group (Fig. 3).

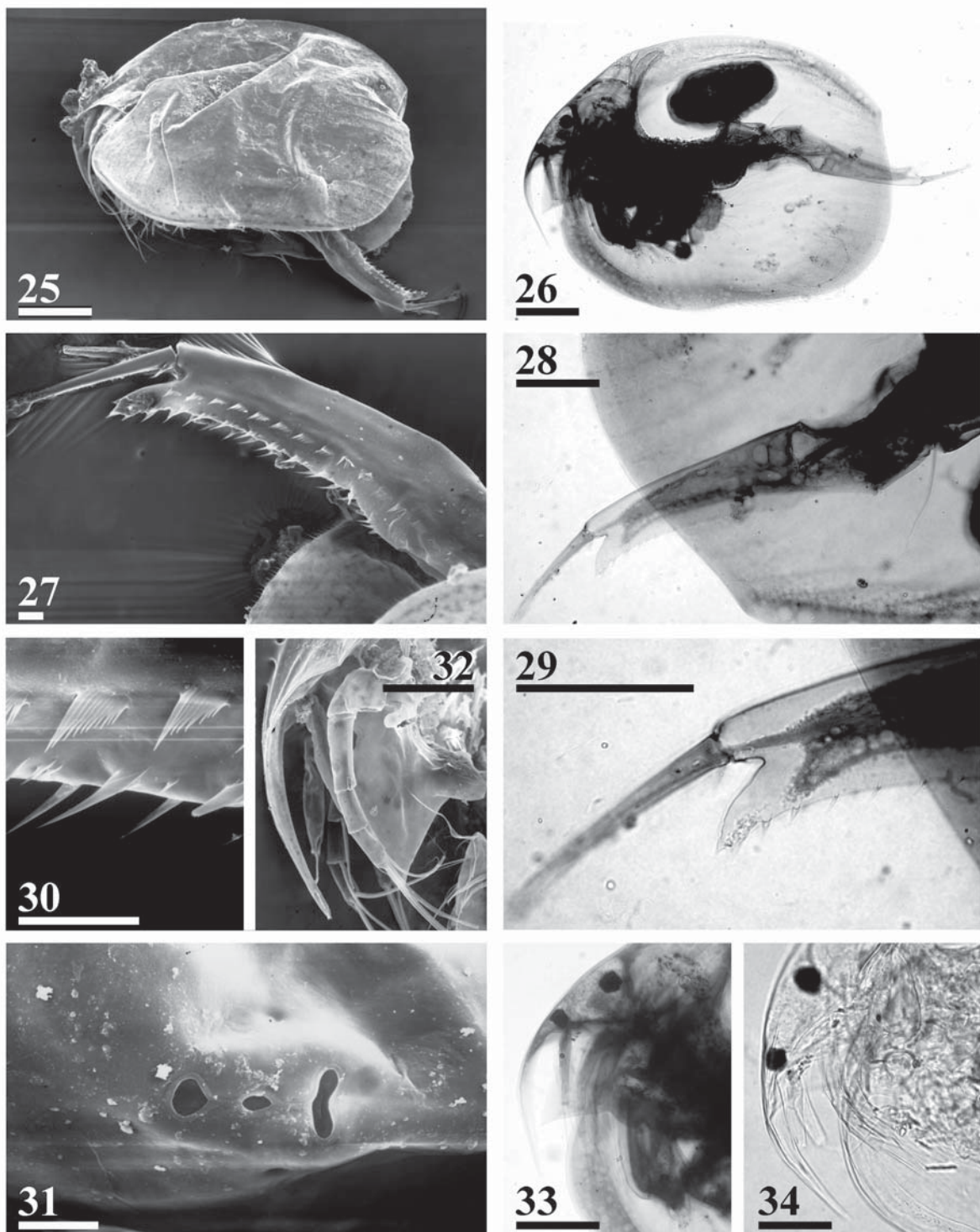
DISCUSSION. Hudec [2000] named his new subgenus *Rostrokurzia* for the especially long rostrum of *K. longirostris* and *K. brevilabris*; just the length of rostrum was regarded as the main diagnostic feature. However, the boundary between the two subgenera according to Hudec [2000] does not follow the boundary between the two main clades within the genus. This anomaly can be rectified easily by relocating *K. media* into the subgenus *K. (Rostrokurzia)*. In this event, the subgenus now includes species with longer or shorter rostra. Below I give emended diagnoses for both subgenera. Note that among all diagnostic characters of *K. (Rostrokurzia)* only an especially fine basal spine is a synapomorphy, while other traits are synplesiomorphies. Also, there was a serious defect in the separation of new subgenus *K. (Rostrokurzia)* by Hudec [2000]: he did not select type species of his new subgenus, so, this taxon of genus-group level is unavailable according to recent rules [ICZN, 2000: paragraphs 42.3.2., 66.1., 67.4.1.]. Rather than reject this unavailable taxon and create a replacement new taxon, I prefer to retain the name of Hudec [2000] to avoid possible confusion with different names for the same taxon in the future. I therefore selected *Alona longirostris* Daday, 1898 (= *K. longirostris* now), one of the most common anomopods in the tropics and subtropics of different continents, as the type species of the subgenus *Kurzia (Rostrokurzia)* (Figs 25–34).

3a. Subgenus *Kurzia (Kurzia)* Dybowski & Grochowski, 1894

Figs 35–43.

Type species: *Alonopsis latissima* Kurz, 1874.

EMENDED SHORT DIAGNOSIS. (1) Postabdomen with almost straight dorsal margin; (2) dorso-



Figs 25–34. Parthenogenetic ♀ of *Kurzia longirostris* from The White Nile near Aljab, Sudan, tube NMK 1536 (25, 27, 30–32); Swamp Fogg Dam via Darwin, Northern Territory, Australia, slide NNS MGU 3228 (26, 28, 29, 33); Toomba Swamp, Queensland, Australia, slide NNS MGU 2784 (34): 25, 26 — lateral view; 27–30 — postabdomen; 31 — head pores; 32–34 — head in lateral view. Scales: 25, 26, 28, 29 — 100 mm; 27, 30–34 — 10 mm.

Рис. 25–34. Парthenогенетическая ♀ *Kurzia longirostris* из Белого Нила около Аляба, Судан, проба NMK 1536 (25, 27, 30–32); Swamp Fogg Dam около Дарвина, Северная Территория, Австралия, препарат NNS MGU 3228 (26, 28, 29, 33); и Toomba Swamp, Квинсленд, Австралия, препарат NNS MGU 2784 (34): 25, 26 — общий вид; 27–30 — постабдомен; 31 — головные поры; 32–34 — голова сбоку. Масштаб: 25, 26, 28, 29 — 100 мм; 27, 30–34 — 10 мм.

distal angle of postabdomen not projected; (3) no robust postanal teeth in distal portion of the postabdomen; (4) basal spine on postabdominal claw thin and long.

3b. Subgenus *Kurzia* (*Rostrokurzia*) Hudec, 2000 emend.nov.

Figs 25–34.

Type species: *Alona longirostris* Daday, 1898.

EMENDED SHORT DIAGNOSIS. (1) Postabdomen with deeply concave dorsal margin; (2) dorso-distal angle of postabdomen remarkably projected; (3) postanal teeth robust (at least in distal portion of the postabdomen); (4) basal spine on postabdominal claw of medium size or shortened.

4. Genus *Nicsmirnovius* Chiambeng & Dumont, 1999

HISTORY OF STUDY. The genus *Nicsmirnovius* was created by Chiambeng & Dumont [1999] for a single species *N. camerounensis* Chiambeng & Dumont, 1999. Subsequently Van Damme *et al.* [2003] relocated previously described *Alona eximia* Kiser, 1948 and *Alonella fitzpatricki* Chien Shing-ming, 1970 in this genus, and described a new species, *N. greeni*, from Africa, and new subspecies, *N. camerounensis dioscoridus*, from Socotra. Then Kotov & Sanoamuang [2004] described in detail the male of *N. eximius*. Kotov [2003] demonstrated that *Alona incredibilis* Smirnov, 1984 is also member of *Nicsmirnovius*.

OUTGROUP AND MATRIX FORMATION. Kotov & Sanoamuang [2004] revealed a series of uniting traits of *Nicsmirnovius* and the *Alona verrucosa*-group, particularly their 8-shaped lateral head pores, not found in any other anomopods. The matrix was formed predominantly using data of Van Damme *et al.* [2003], Kotov & Sanoamuang [2004] and Kotov [2003].

Character descriptions for *Nicsmirnovius* as follows (p — present; a — absent):

1. Compound eye absent (a = 0, p = 1);
2. Labral keel with elongated apex (a = 0, p = 1);
3. Setae at post-ventral angle of valve long (a = 0, p = 1);
4. Postabdominal claw with short basal spine (a = 0, p = 1);
5. Antenna I elongated (a = 0, p = 1);
6. Peg-like projection at base of antenna I (a = 0, p = 1);
7. Limb III, sensillum basally to scrapers small (a = 0, p = 1);
8. On limb IV there are 4 soft setae (0), 3 reduced setae (1), a single long seta (2);

Data matrix of 8 morphological characters used in cladistic analysis of *Nicsmirnovius* as follows:

Taxon	1	2	3	4	5	6	7	8
<i>N. incredibilis</i>	0	0	0	0	0	0	-	-
<i>N. eximius</i>	0	0	0	0	0	0	1	1
<i>N. greeni</i>	0	0	0	0	0	0	1	1
<i>N. fitzpatricki</i>	0	1	0	0	1	1	0	2
<i>N. camerounensis camerounensis</i>	1	1	1	1	1	1	0	2
<i>N. camerounensis dioscoridus</i>	1	1	1	1	1	1	0	2
<i>Alona verrucosa</i>	0	0	0	0	0	0	0	0

TREE DESCRIPTION. My analysis with all characters unordered yielded four most-parsimonious trees (TL = 10, CI = 1.00, RI = 1.0), a consensus tree is represented in Fig. 4. The bootstrap test led to a tree which was different from the contree in the grouping of *N. eximius* and *N. greeni* (with low probability, 51%). The contree is greatly polytomic due to absence of information on *N. incredibilis*, re-studied based only on the type slide [Kotov, 2003]. After exclusion of this poorly studied taxon, a single tree was obtained (TL = 9, CI = 1.00, RI = 1.0) (Fig. 5). Bootstrap test yielded a tree with topology exactly the same with aforementioned contree, and with acceptable probabilities for all branches.

Thus, there are two main clades in *Nicsmirnovius*: *N. eximius/N. greeni* and *N. camerounensis* (with two subspecies)/*N. fitzpatricki*. The position of *N. incredibilis* is unknown due to insufficient study.

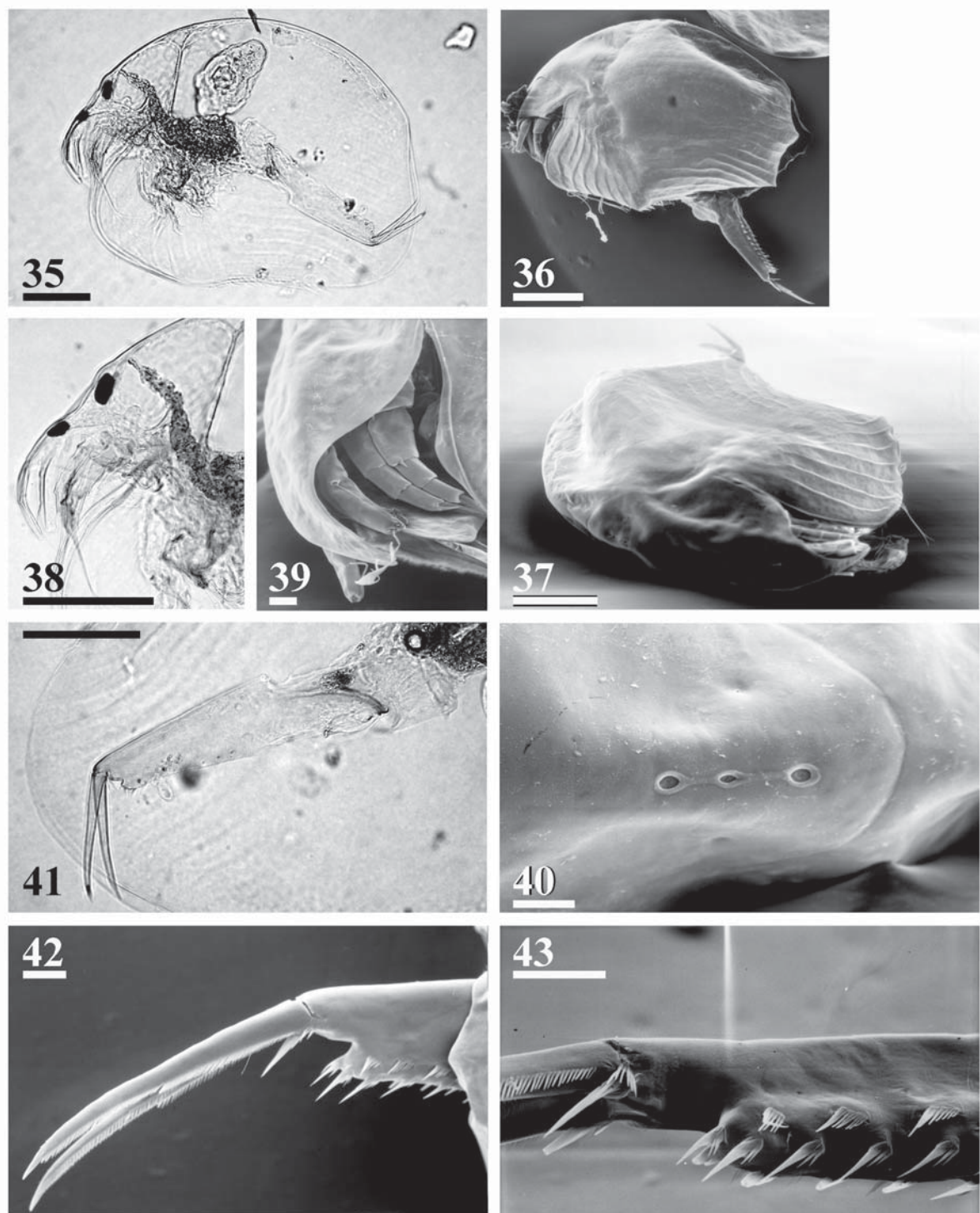
DISCUSSION. In any variants of search, African-Socotran *N. camerounensis* is grouped with American *N. fitzpatricki* versus other taxa.

General conclusions

(1) Previous suggestions of subdivision of *Kozhowia* into two species groups by Kotov [2000] and *Kurzia* into two subgenera by Hudec [2000] are not supported by cladistic analysis. The cladistic approach is helpful to avoid similar mistakes.

(2) Different patterns of inter-continental grouping of species were revealed. For example, in *Karualona*, two American species (*K. pennuelasi* and *K. muelleri*) are grouped together, while in *Nicsmirnovius* the American representative *N. fitzpatricki* is grouped with African *N. camerounensis* versus other Afro-Asian species. Nevertheless, we can now use the represented data for the construction of a phylogeography of the Anomopoda. No doubt new species may be found in some of discussed genera. The majority of populations of all these genera (except *Kozhowia*) need an accurate revision.

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Figs 35–43. Parthenogenetic ♀ of *Kurzia latissima* from a pond in the Yakot' fish farm, Moscow Area, European Russia, slide NNS MGU 2208 (35, 38, 41) and tube NNS 1998-154 (36, 37, 39, 40, 42, 43): 35, 36 — lateral view; 37 — anterior view; 38, 39 — head; 40 — head pores; 41–43 — postabdomen. Scales: 35–38, 41 — 100 μm; 39, 40, 42, 43 — 10 μm.

Рис. 35–43. Партегенетическая ♀ *Kurzia latissima* из пруда рыбхоза "Якоть", Московская область, Европейская Россия, препарат NNS MGU 2208 (35, 38, 41) и проба NNS 1998-154 (36, 37, 39, 40, 42, 43): 35, 36 — вид сбоку; 37 — вид спереди; 38, 39 — голова; 40 — головные поры; 41–43 — постабдомен. Масштаб: 35–38, 41 — 100 мкм; 39, 40, 42, 43 — 10 мкм.

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