

ON A TAXONOMY OF PREDATORY MITES OF THE GENUS *NEOEUCHEYLA* RADFORD, 1950 AND RELATED GENERA (ACARI: CHEYLETIDAE)

К СИСТЕМАТИКЕ ХИЩНЫХ КЛЕЩЕЙ РОДА *NEOEUCHEYLA* RADFORD, 1950 И БЛИЗКИХ К НЕМУ РОДОВ (ACARI: CHEYLETIDAE)

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ABSTRACT

Relationships within the *Neoeucheylea* generic group (Acari: Cheyletidae) are studied by means of cladistic methods with HENNIG 86 software. The analysis of 12 species shows, that this group consists of 3 valid genera: *Neoeucheylea* Radford, 1950 (2 species), *Bothrocheylea* (3 species) and *Cunlifella* (7 species). The latter genus includes two species groups which are characterized by presence or absence of vesicular chambers. New improved diagnoses are proposed for all three genera.

РЕЗЮМЕ

Взаимоотношения внутри родового комплекса *Neoeucheylea* (Acari: Cheyletidae) изучены с помощью кладистической программы HENNIG 86. Анализ связей между 12 видами, входящими в этот комплекс, позволил выделить 3 группы, которым придается родовой статус: *Bothrocheylea* (3 вида), *Neoeucheylea* (2 вида), *Cunlifella* (7 видов). Последний род включает две группы видов, различающиеся по наличию или отсутствию у их представителей тимпанальных органов (vesicular chambers). Составлены новые диагнозы всех 3 родов.

INTRODUCTION

The tribe Cheyletiini Volgin, 1969 (Cheyletidae: Cheyletinae) contains well restricted *Neoeucheylea* generic group, which members are characterized by the mice-shaped seta on the palpal tarsus (Fig. 1). The majority of species attributed to this generic group recently including 14 species were originally described within the genus *Neoeucheylea* Radford, 1950 [Radford, 1950; Volgin, 1969; Wafa, Soliman, 1968; Summers, Price, 1970; Soliman, 1972; Thewke, Enns, 1972; Barilo, 1985, 1986; Gupta, Paul, 1992]. However, the recent taxonomic experts have rather different points of view on assignation of these species to certain genera and subgenera of this generic group [Volgin, 1969; Summers, Price, 1970], because these experts attached different taxonomic value to diagnostic characters.

The genus *Neoeucheylea* originally included only the type species *N.loricata* (Berlese, 1913) [Radford, 1950]. Volgin [1964] had added to *Neoeucheylea* 5 more species and established a new monotypic subgenus the *Bothrocheylea*, because *N.(B.) pavlovskiyi* Volgin, 1964 had difference chaetotaxy of palps and tibiae II. Later, Volgin [1969] had risen *Bothrocheylea* up to generic rank, and again divided the genus *Neoeucheylea* into two subgenera, *Neoeucheylea* s.str. and *Cunlifella* Volgin, 1969. The main difference between these subgenera was the presence in *Cunlifella* of so-called vesicular chambers, which actually were ovoid porous fields, situated at posterior ends of peritremes.

Summers and Price [1970] had another point of view and abolished the taxon *Bothrocheylea*, considering it as a synonym of the genus *Neoeucheylea*. They based on a similarity of idiosomal chaetom and did not take in attention the difference in the palpal chaetom. At the same time these experts had risen up the subgenus *Cunlifella* to the generic rank, because they gave a high taxonomic importance to such characters as the vesicular chambers and «absence» of subcapitular setae [Summers, Price, 1970]. It is necessary to note that subcapitular setae are actually present in the genus *Cunlifella*. Besides, the structure of gnathosoma in such species as *N.mumai* Volgin, 1969, *N.bulgarica* (Volgin, 1955), *N.ornata* Wafa et Soliman, 1968, which were left by Summers and Price [1970] in the genus *Neoeucheylea*, differs from that in typical representatives of the genus *Cunlifella* only by the absence of vesicular chambers.

MATERIAL AND METHODS

The material for the present study was the cheyletid mite collection deposited at Zoological Institute of Russian Academy of Sciences (St. Petersburg, Russia). We have examined materials on 6 species (marked with in the Table 2), characters of 6 species were obtained from careful descriptions. Unfortunately, we could not use the morphological data of two species, *N.ploceus* Gupta et Paul, 1992 and *N.macrocornis* Soliman, 1975, because the type materials were not accessible and

Table 1.

List of character states in the *Neoeucheyla* generic group

- I. Ventral hair-like seta: 0 — setiform; 1 — bifurcate (Fig. 1).
 II. Lateral seta of palp tarsus: 0 — hair-like, 1 — mice-shaped (Figs. 1,3,4).
 III. Dorsal seta of palp tibia: 0 — scale-like (Fig. 3); 1 — brush-like (Fig. 4); 2 — thickened brush-like (Fig. 1).
 IV. Seta on palp genu: 0 — present; 1 — absent.
 V. Ventral seta v2 of palp femur: 0 — it lateral to seta v1 (Figs. 3,4); 1 — it medial to v1 (Fig. 1).
 VI. Rostral shield: 0 — similar in wide to rostrum, with rounded anterior margin; 1 — slightly wider than rostrum, with rounded anterior margin and little medial notch (Fig. 1); 2 — wider than rostrum about two times, with rounded anterior margin (Fig. 4); 3 — slightly wider than rostrum, with straight margin, carrying two lateral teeth (Fig. 3).
 VII. Peritremes: 0 — arch-like (Fig. 3), 1 — with elongated apex (Fig. 1); 2 — with concave apex (Fig. 4).
 VIII. Vesicular chambers: 0 — absent; 1 — present (Fig. 4).
 IX. Setae of tibia II: 0 — 2 hair-like, 2 scale-like; 1 — 1 hair-like, 3 scale-like.
 X. Number of pairs of medial scale-like setae of propodosomal shield: 0 — absent; 1 — 3 pairs; 2 — 4 pairs.
 XI. Cloud-like setae (Fig. 4c) no dorsal idiosoma shields: 0 — present, 1 — absent.
 XII. Palpal claw: 0 — with 1 teeth; 1 — with 3–5 little teeth; 2 — with 5–8 big teeth.

0 — plesiomorphic state, 1 — apomorphic state.

Table 2.

Data matrix of the *Neoeucheyla* generic group (species*)

Taxa	Characters*											
	1	2	3	4	5	6	7	8	9	10	11	12
outgroup <i>Cheyletia aradiophila</i> Volgin, 1966	0	0	0	0	0	0	0	0	1	0	0	1
* <i>tuberculicoxa</i> Volgin, 1964	0	1	1	1	0	2	2	1	1	0	0	2
<i>whartoni</i> Backer, 1949	0	1	1	1	0	2	2	1	1	0	0	2
<i>panamensis</i> Backer, 1949	0	1	1	1	0	2	2	1	1	2	0	2
* <i>variegata</i> Barilo, 1985	0	1	1	1	0	2	2	1	1	1	0	2
* <i>bulgarica</i> Volgin, 1955	0	1	1	1	0	2	2	0	1	0	0	2
* <i>mumai</i> Volgin, 1969	0	1	1	1	0	2	2	0	1	1	1	2
<i>ornata</i> Wafa et Soliman, 1968	0	1	1	1	0	2	2	0	1	1	1	2
<i>loricata</i> Berlese, 1913	0	1	1	1	0	3	0	0	1	0	0	0
* <i>minuta</i> Barilo, 1986	0	1	1	1	0	3	0	0	1	1	1	0
* <i>pavlovskiyi</i> Volgin, 19694	1	1	2	0	1	1	1	0	0	1	0	1
<i>typhosa</i> Summers et Price, 1970	1	1	2	0	1	1	1	0	0	1	0	1
<i>beeri</i> Thewke et Enns, 1972	1	1	2	0	1	1	1	0	0	1	0	1

**Descriptions of the characters and character states are presented in Table 1.

the descriptions were uncomplete [Gupta et Paul, 1992; Soliman, 1975].

The present paper gives a new taxonomic system of the *Neoeucheyla* generic group based on cladistic methods. The HENNIG 86 software was used for the cladistic analysis. We used 12 species and 12 morphological characters for the analysis of the generic group (Table 1,2). Only a few characters are a result of exclusion of

autapomorphies. We also did not use such characters as the number of processes on palpal claws and the number of cloud-like setae because of their variability within certain species.

RESULTS

In a result of analysis we have obtained 14 trees (23 steps, ci=78, ri=86). The Nelsen consensus tree

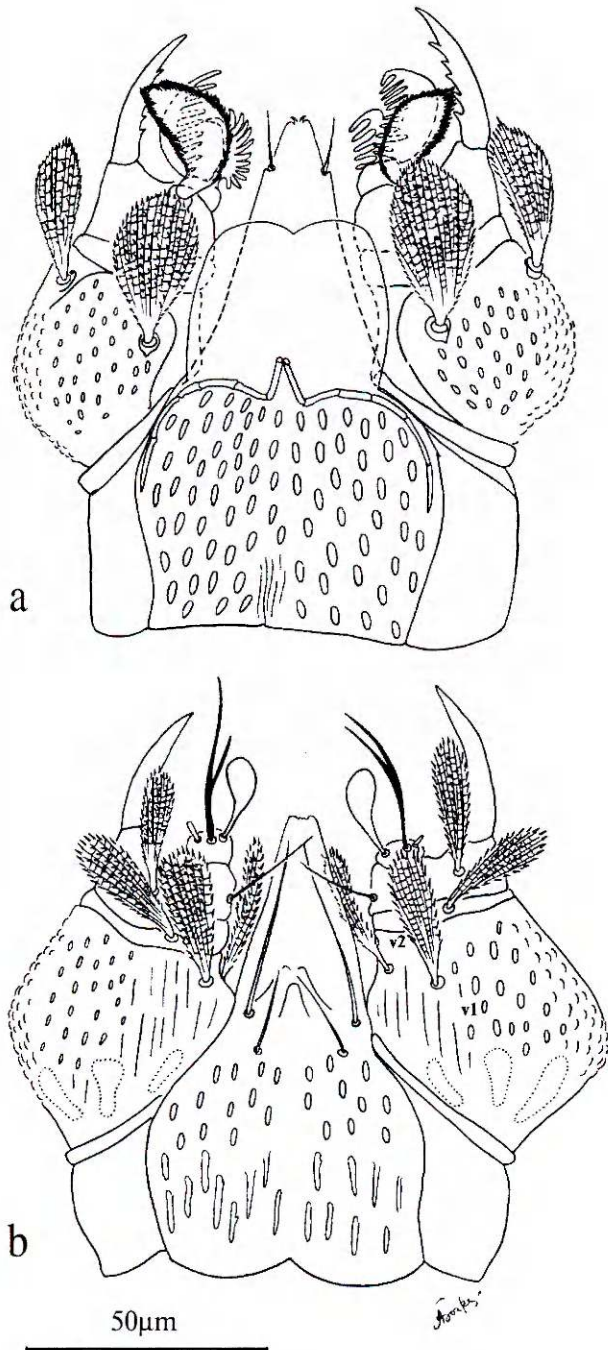


Fig. 1. *Bothrocheylea pavlovskiyi*, gnathosoma of female: a — dorsal view, b — ventral view.

Рис. 1. *Bothrocheylea pavlovskiyi*, гнатосома самки: а — дорсально, б — вентрально.

is displayed on Fig. 2. Within all 14 trees three clusters being invariable by set of included species and topological position in the trees are clearly recognized: *pavlovskiyi* (3 species), *loricata* (2 species) and *tuberculicoxa* (7 species) clusters. The variability of trees is caused by the number of lateral and medial scale-like setae (characters 10, 11). These characters are probably specific characteristics only (homoplasies) and they do not correlate with the characters 8 (presence or absence of vesicular chambers) and 9 (form of setae of tibia II).

Within the *tuberculicoxa* cluster two formal subgroups can be recognized by the state based on

the character 8. They are obviously *tuberculicoxa* group, having the vesicular chambers, and the *bulgarica* group, without these chambers.

Based on a stability of all three main clusters by set of including species, their position in the cladograms and a possibility to characterize them by complex of morphological character we consider them as three distinct genera of the generic group in question: *Neoeucheyla* (= *loricata* cluster), *Cunlifella* (= *tuberculicoxa* cluster) and *Bothrocheylea* (= *pavlovskiyi* cluster).

DIAGNOSES OF GENERA

Neoeucheyla Radford, 1950

Type species: *Cheyletia loricata* Berlese, 1913.

Gnathosoma (Fig. 3A). Palpal tarsus with 2 comb-like setae, 1 mice-shaped seta and 1 hair-like seta. Palpal tibia with 3 setae: 1 dorsal scale-like, 1 ventral scale-like and 1 hair-like. Palpal genu without setae. Palpal femur with 4 pairs of scale-like setae, seta *v2* situated lateral to seta *v1*. Palpal claw with 1 processus. Rostrum slightly narrower than rostral shield. Rostral shield with straight anterior margin, carrying one pair of lateral teeth. Peritremes resembles simple arch.

Idiosoma (Fig. 3B). Propodosomal and hysterosomal shields present, well developed. Eyes present. Setae *vi*, *ve*, *sci*, *sce*, *d5*, *l1–l5* are scale-like.

Legs. Tibia I with 5 setae: 4 scale-like and 1 hair-like; tibia II–IV with 3 scale-like setae and 1 hair-like seta. Teguments of body and legs weakly granulated.

This genus surely includes 2 species (Fig. 2). Two other species, *N. places* Gupta et Paul, 1992 and *N. macrocorneus* Soliman, 1975 described incompletely, could be assigned to this genus only conditionally.

Bothrocheylea Volgin, 1964

Type species: *Neoeucheyla (Bothrocheylea) pavlovskiyi* Volgin, 1964

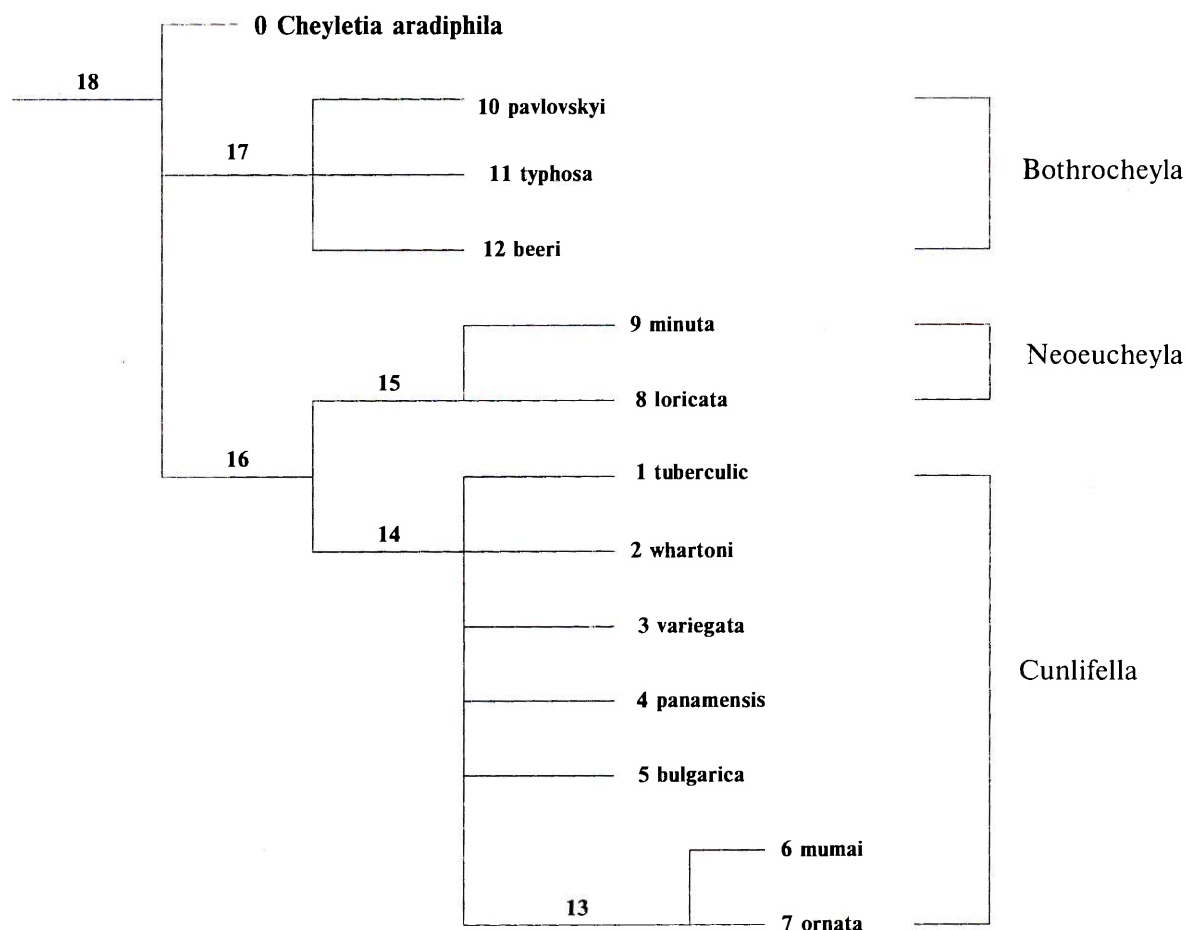
Gnathosoma (Fig. 1). Palpal tarsus with 2 comb-like setae, 1 mice-shaped seta and 1 bifurcated seta. Palpal tibia with 3 setae: 1 dorsal thick brush-like, 1 ventral scale-like and 1 lateral hair-like. Palpal genu with 1 ventral seta. Palpal femur with 4 pairs of scale-like setae, seta *v2* situated medial to seta *v1*. Palpal claw with 1–5 little processes. Rostrum: 1 — slightly wider than rostrum, with rounded anterior margin and slightly notched. Peritremes arch-like, with elongated apex.

Idiosoma. Propodosomal and hysterosomal shields present, well developed. Eyes present. Setae *vi*, *ve*, *sci*, *sce*, *d5*, *l1–l5* are scale-like.

Legs. Tibia I bearing 5 setae: 4 scale-like and 1 hair-like; tibia II–IV bearing 2 scale-like setae and 2 hair-like setae. Teguments of body and legs well granulated.

This genus includes 3 species (Fig. 2).

Remarks. According to the differential diagnosis of *B. beeri*, it differs from *B. pavlovskiyi* only by the



Hennig 86: mh bb*, nelsen consensus from 14 trees length 23, ci=78, ri=86

Fig. 2. Cladogram the *Neoeucheylea* generic group.

Рис. 2. Система группы родов *Neoeucheylea*.

greater number of cloud-like setae on hysterosomal shield (6 pairs) [Thewke et Enns, 1972]. However, the study of the type series of *B.pavlovskyi* has shown, that this character is variable, because the number of cloud-like setae in some specimens was also 6 pairs. Another discriminative character pointed out in diagnosis. The dorsal scale-like setae of palpal tibiae in *B.pavlovskyi* and thickened brush-like ones in *B.beeri*, is invalid, as far this setae are incorrectly figured for *B.pavlovskyi*.

Cunlifella Volgin, 1969

Type species: *Neoeucheylea tuberculicoxa* Volgin, 1964

Gnathosoma (Fig. 4a,b). Palpal tarsus having 2 comb-like setae, 1 mice-shaped seta and 1 hair-like seta. Palpal tibia with 3 setae: 1 dorsal scale-like, 1 ventral scale-like and 1 lateral hair-like. Palpal genu without setae. Palpal femur with 4 pairs of scale-like setae, seta v_2 situated lateral to v_1 . Claws of palps with big teeth-like processes along all internal margin. Rostral shield wider than rostrum about two times, its anterior margin widely rounded. Peritremes resemble an arch with concave apex.

Idiosoma. Propodosomal and hysterosomal shields present, very developed. Eyes present. Setae v_i , v_e , sci , sce , d_5 , l_1 – l_5 are scale-like.

Legs. Tibia I bearing 5 setae: 4 scale-like and 1 hair-like; tibia II–IV bearing 3 scale-like setae and 1

hair-like seta. Teguments of body and legs are weakly granulated.

This genus includes 7 species arranged into 2 groups: «*tuberculicoxa*» group (4 species) — with vesicular chambers; «*bulgarica*» group (3 species) — without vesicular chambers.

Remarks. 1. The structure of medial setae of propodosomal shields was considered as a clear specific character and is widely used for the discrimination of species of the genus *Cunlifella*. However, the study of the type series of *C.bulgarica* (12 females) has shown a difference in a morphology of these setae, whereas the number of these setae remains constant (6 pairs). There are four variations in the morphology of propodosomal shield setae (Fig. 5). The variant «*typica*» occurred in 4 specimens, including the holotype, the variant «*paradoxa*» was observed in 6 specimens, variants «*anomalica*» and «*assymetrica*» each occurred in one specimen. All mites of the type series belongs to one collection point: Bulgaria, Pazargikskiy district, the vine, 18. 10. 1955. Z.Zankov coll. Therefore we consider that the morphology of the propodosomal shield setae in females of this species is variable. A sympatric occurrence of two or more closely related species together in one location looks impossible. On the other hand, often appearance of aberrant forms causes doubts in a high diagnostic value of this character for *C.bulgarica*.



Fig. 3. *Neoeucheyla minuta*, female (afte: Barilo, 1986): a — gnathosoma, dorsal view; b — total, dorsal view.
 Рис. 3. Самка *Neoeucheyla minuta* Barilo (по: Barilo, 1986): а — гнатосома, дорсально; б — общий вид, дорсально.

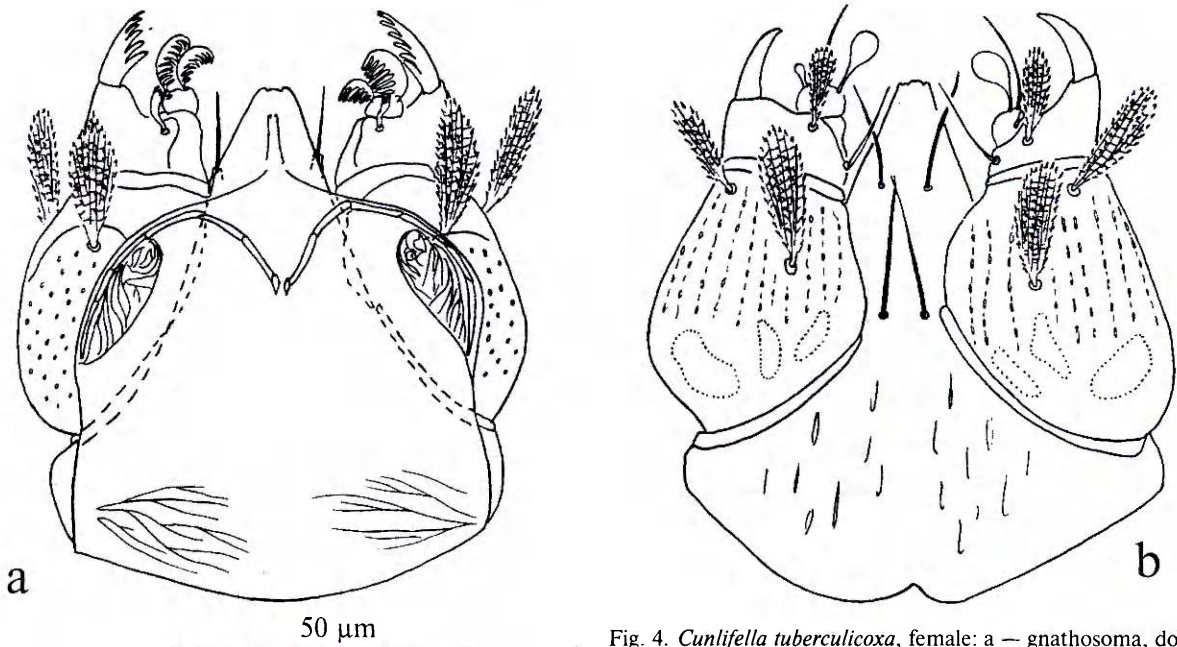
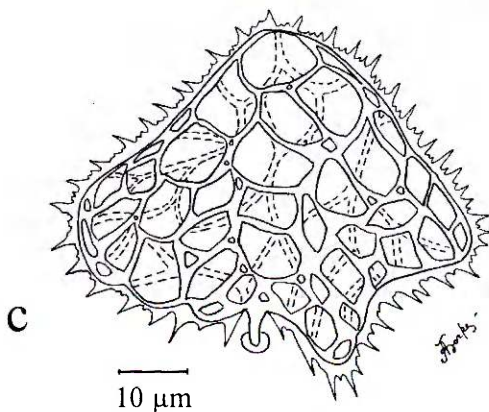


Fig. 4. *Cunlifella tuberculicoxa*, female: a — gnathosoma, dorsal view, b — gnathosoma, ventral view, c — cloud-like seta.
 Рис. 4. *Cunlifella tuberculicoxa*, самка: а — гнатосома дорсально, б — то же, вентрально, с — облакоподобная щетинка.

2. *C.ornata* (Wafa, Soliman, 1968) is very similar to *C.mumai* Volgin, 1969 and differs only by the absence of setae *d5*, which is present in all other species of the *Neoeucheyla* generic group, but often covered with setae *l5*. It is quite possible that these two named species are conspecific.

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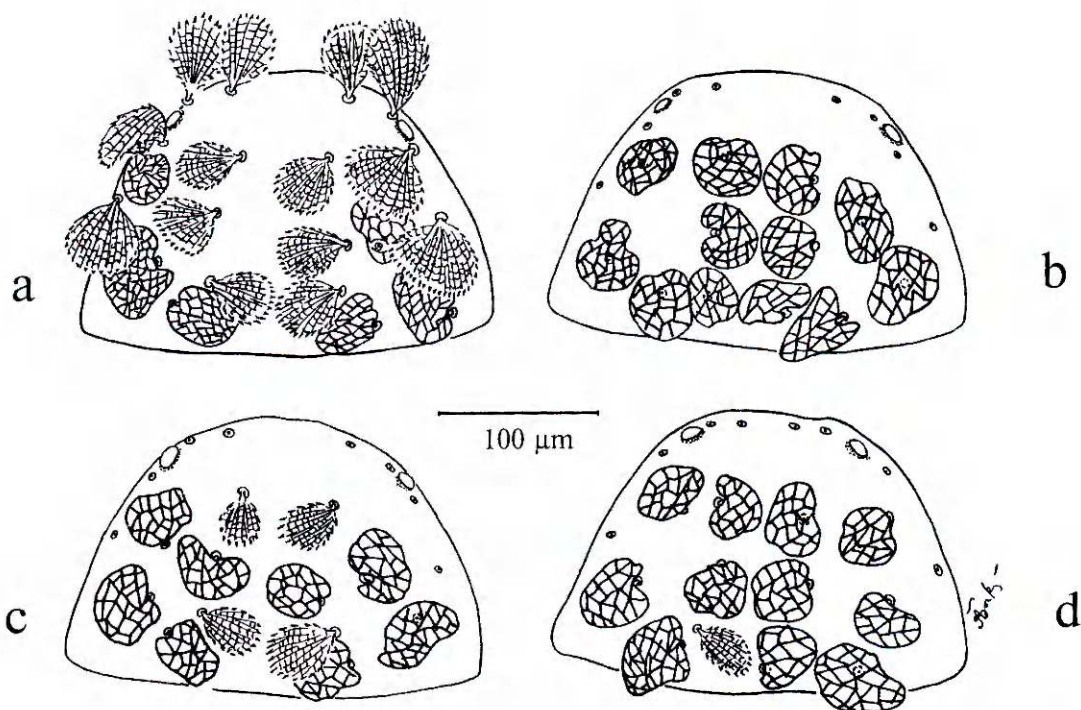


Fig. 5. Variants of propodosomal shield chaetotaxy in females in *Cunlifella bulgarica*: a — var. «typica» (4 specimens), b — var. «paradoxa» (6 specimens), c — var. «anomalía» (1 specimen), d — var. «assymetrica» (1 specimen).

Рис. 5. Варианты хетотаксии проподосомального щита самки *Cunlifella bulgarica*: а — вариант «typica» (4 экземпляра), б — вариант «paradoxa» (6 экземпляров), с — вариант «anomalía» (1 экземпляр), d — вариант «assymetrica» (1 экземпляр).

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