

Redescription of *Diacyclops alticola* Kiefer, 1935 (Copepoda, Cyclopoida) from the Pamirs (Tajikistan)

Iskandar MIRABDULLAYEV, Nazira RUSTAMOVA
Institute of Zoology, Niyazov str. 1, Tashkent, 100095, UZBEKISTAN

Received: 12.01.2007

Abstract: *Diacyclops alticola*, a poorly known cyclopoid, is redescribed on specimens from a shallow pool near Lake Rang-Kul in the Pamirs (Tajikistan) at an altitude of 3700 m. Synonymy of *D. alticola* Kiefer, 1935 and *D. longifurcus* Shen et Sung, 1963 is proposed. A key to the species of the genus *Diacyclops* Kiefer, 1927 in Central Asia is presented.

Key Words: Cyclopoida, *Diacyclops alticola*, redescription, the Pamirs, Central Asia

Introduction

Diacyclops alticola is a poorly known species briefly described by F. Kiefer (1935) from southwest Tibet. While studying the old samples of Prof. V.F. Gurvich's collection from the Pamirs, several specimens of this species have been examined. In this note, females and males of *Diacyclops alticola* are redescribed.

Materials and Methods

Material examined: 8 females and 3 males from a shallow pool at the shore of Lake Rang-Kul (38°28'N, 74°08'E), the Pamirs, Tajikistan. The sample was collected by Prof. V.F. Gurvich in July 1959.

All drawings were made using a drawing tube.

Designations of furcal setae are given as follows: Ti, innermost apical furcal seta; Te, outer apical furcal seta; Tme, outer middle apical furcal seta; Tmi, inner middle apical furcal seta; Sd, dorsal furcal seta; Me, lateral furcal seta. Pereopods (legs) 1-5 are designated as P1-P5, endopodite as enp.

Results

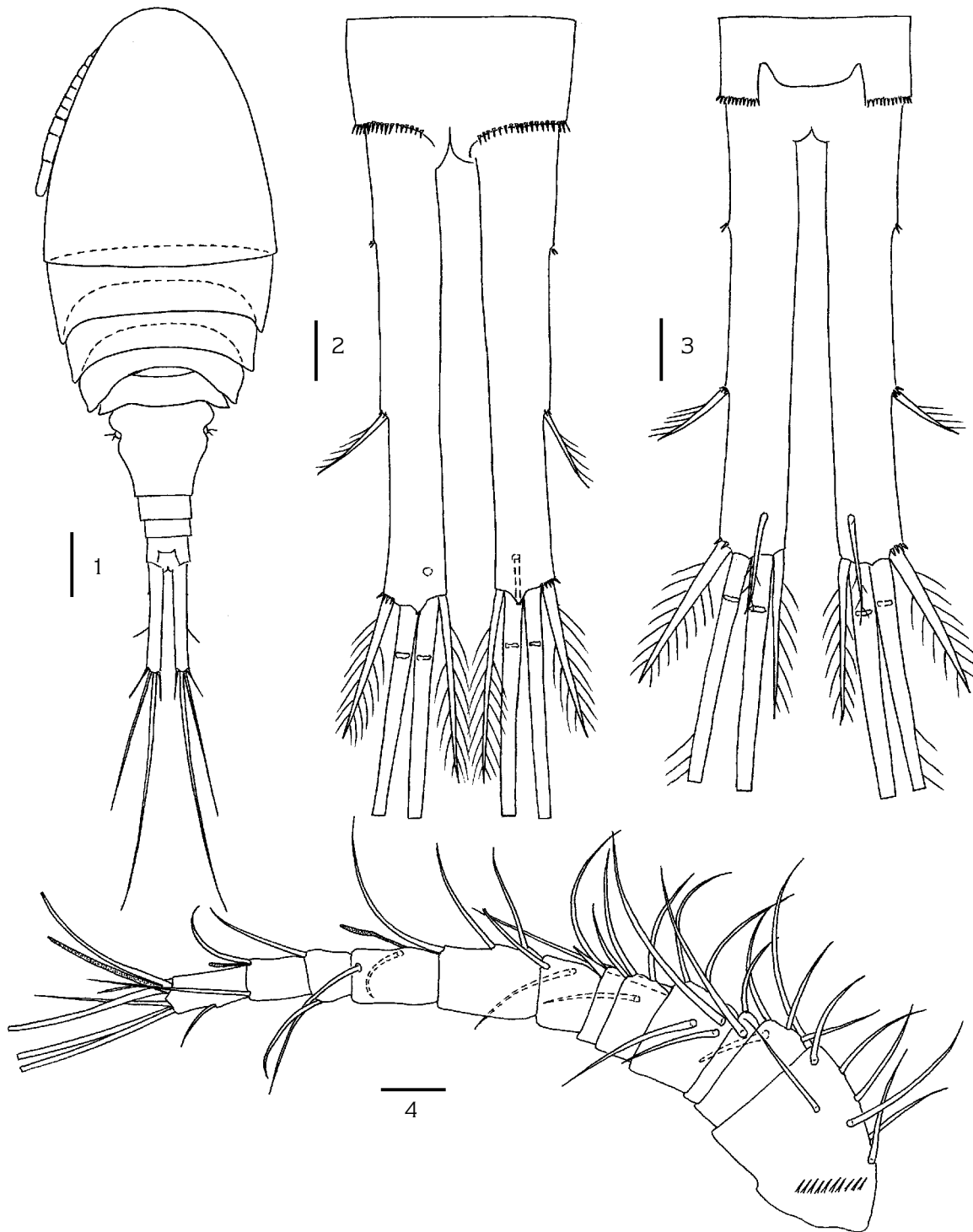
Diacyclops alticola Kiefer, 1935

Female. Body length 900-1050 µm. Body widest at cephalothorax (Figure 1). Lateral sides of 5th thoracic somite without ornamentation. Genital double-somite about as long as wide. Posterior margin of anal somite bearing spinules on dorsal, ventral, and lateral sides (Figures 2 and 3). Anal operculum markedly developed, convex (Figure 3).

Furcal rami: parallel, 6.4-7.5 times as long as wide, with smooth inner surface (Figures 2 and 3). Insertions of Me and Te furcal setae provided with spinules. Plumage of Tmi and Tme furcal setae homogeneous. Lateral seta situated in posterior half, at about 60% of total length of ramus. Ti about 3 times shorter than caudal ramus, about as long as Te and markedly longer than Sd.

Antennules (Figure 4): 12-segmented, short, reaching middle of cephalothorax, armored as follows (segment number in Roman numerals, setal number in Arabic numerals, aesth = aesthetasc, sp = spine):

* E-mail: imirabdullayev@yahoo.com



Figures 1-4. *Diacyclops alticola*, female. 1, habitus; 2, furcal ramus ventrally; 3, furcal ramus, dorsally; 4, antennule. Scales: 1, 100 μm ; 2-4, 25 μm .

I(8)-II(4)-III(2)-IV(6)-V(4)-VI(1+sp)-VII(2)-VIII(3)-IX(2+aesth)-X(2)-XI(2+aesth)-XII(7+aesth).

Antenna (Figure 5): basipodite bearing 3 setae, inner seta much longer than outer setae; its caudal side with 2 rows of spinules, frontal side with 1 straight and 1 curved rows of spinules. Second endopodite bearing 9 setae, last segment with 7 setae.

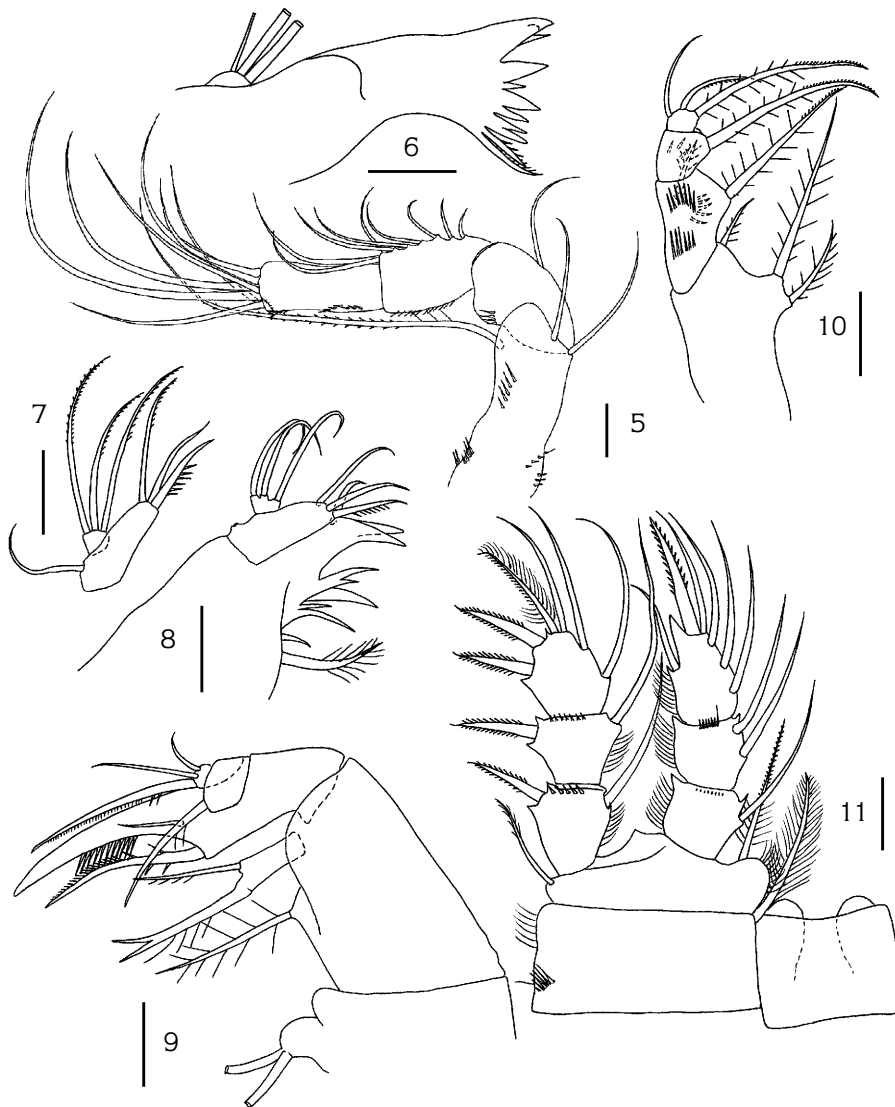
Mandible typical for the genus (Figure 6). Mandibular palp with 2 long and 1 short setae.

Maxillule: The segmentation and setation follow the typical cyclopine pattern, palp is bare (Figures 7 and 8).

Maxilla as in Figure 9, typical for the genus.

Maxilliped: consists of syncoxopodite, basipodite, and 2-segmented endopodite, with 3, 2, 1, and 3 setae, respectively. Scale-like spinules on caudal surface of basipodite arranged in 2 groups (Figure 10).

Natatorial legs with 3-segmented rami. Spine formula 2.3.3.3, setae formula 4.4.4.4 (Figures 11-14). Coxopodites P1-P3 with short row of spinules on caudal surface. Caudal surface of coxopodite P4 with 1 broken distal, 2 long proximal, 1 short lateral rows and latero-distal group of spinules (Figure 14). Basis of P1 with long



Figures 5-11. *Diacyclops alticola*, female. 5. antenna; 6. mandible; 7. maxillule; 8. maxillular palp; 9. maxilla; 10. maxilliped; 11. P1. Scales: 25 μ m.



Figures 12 and 13. *Diacyclops alticola*, female. 12, P2; 13, P3. Scales: 25 μ m.

robust spine reaching end of P1enp2 (Figure 11). Inner margin of basis of P1-P4 bearing setules. Intercoxal plates of P1-P4 smooth, bearing broadly rounded prominences on distal margin. Spines of P1 exopodite with thin flexible ends (Figure 11). P4enp3 LW = 1.7-2.0. Inner terminal spine about 2-fold shorter than the article and 0.57-0.68 as long as outer spine (Figure 14).

P5 typical for the genus (Figure 15).

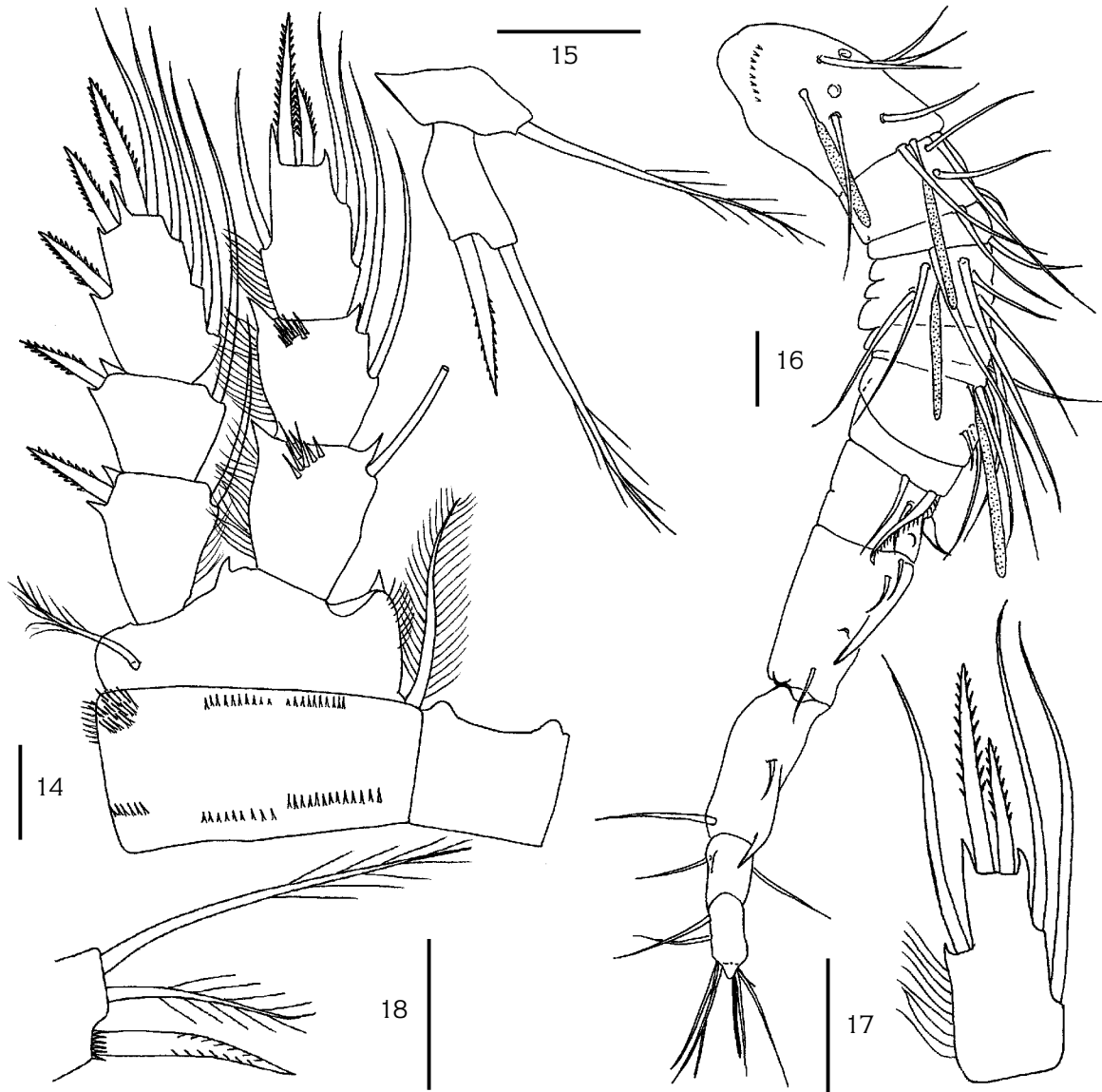
Data on variability presented in the Table.

Male. Body length 780-920 μ m. Antennule as in Figure 16. Aesthetascs of medium size. Morphology of furcal ramus, legs and mouthparts similar to that of female. However, Ti slightly longer than in female. In contrast to female, second endopodite of male antenna bearing 8 setae. Apical spines of Enp3P4 of male slightly longer than in female (Figure 17). Outer seta of P6 about 1.5-2.0 times as long as middle seta and inner spine; insertion of the spine adorned with spinules (Figure 18).

Ecology. Lake Rang-Kul is a shallow freshwater (water mineralization 355-463 mg/l) lake situated at an altitude of 3700 m above sea level. Mid-summer temperature 13 $^{\circ}$ C, reaching 21 $^{\circ}$ C. Zooplankton species co-occurring with *D. alticola*: *Eucyclops* cf. *serrulatus* (Fischer, 1851), *Acanthodiptomus denticornis* (Wierzejski, 1887), *Daphnia longispina* Müller, 1785, *Chydorus* sp.

Discussion

Diacyclops alticola has been described from mountain water bodies (4252 m and 4977 m above sea level) in Tibet (Ladakh, Jammu and Kashmir). The original description of *D. alticola* was incomplete (Kiefer, 1935). Later, Kiefer (1939) expanded the description of this species, presenting some data on its variability. The morphology of the specimens from the Pamirs readily fits the description given by F. Kiefer. In the Pamirs, Lake



Figures 14-17. *Diacyclops alticola*, 14, P4 of female; 15, P5 of female; 16, antennule of male; 17, Enp3P4 of male; 18, P6 of male. Scales: 25 μ m.

Rang-Kul is situated about 400 km north of Ladakh, terra typica for *D. alticola*.

Diacyclops longifurcus Shen et Sung, 1963, also described from mountain lakes in Tibet (at the altitude of 4350 m), is apparently conspecific with *D. alticola* Kiefer, 1935. Shen et al. (1979) pointed out that *Diacyclops longifurcus* has slightly longer furca ($L/W = 7.5$) than *D. alticola* ($L/W = 6.5$). However, it is obviously a very close value, not enough for separation of the species. Our data

(Table) show that the furcal index of *D. alticola* may vary in limits at least 6.4-7.5.

Diacyclops alticola belongs to the *D. crassicaudis* species complex, whose members are characterized by a 12-segmented antennula and P1-P4 with both rami 3-segmented (Reid, 1992; Pesce and De Laurentiis, 1996; De Laurentiis et al., 1999). *Diacyclops alticola* is close to Australian *D. humphreysi* Pesce et De Laurentiis, 1996 in having the inner apical spine of P4 enp3 shorter than the

Table. Data of measurements of *Diacyclops alticola*. Data in parentheses are derived from published drawings.

	<i>D. alticola</i>							<i>D. longifurcus</i>
	the Pamirs				Tibet (Kiefer, 1939)			Tibet (Shen et al., 1979)
	Females n = 8		Males n = 3		Females n = 3		Males n = 1	Females
	x	min-max	x	min-max	x	min-max		
Body L, µm	1000	900-1050	847	780-920	1030	940-1100	-	1100-1300
Fu L/W	7.1	6.4-7.5	6.8	6.7-7.5	6.5	6.2-6.9	6.2	7.5
Ti/Fu	0.35	0.32-0.39	0.43	0.39-0.46	~0.33	-	-	1/4
Ti/Te	1.05	0.96-1.14	1.25	1.09-1.42	~1.0	-	-	~1.0
Ti/Sd	1.44	1.28-1.60	1.70	1.61-2.00	~1.0	-	-	~1.0
Enp3P4:								
L/W	1.80	1.69-2.00	1.97	1.89-2.00	1.75	1.68-1.79	1.85	(2.0)
Inner sp./ L	0.51	0.48-0.54	0.61	0.60-0.63	0.56	0.52-0.60	0.71	(0.5)
Inner sp. / outer sp.	0.61	0.57-0.68	0.64	0.63-0.65	0.61	0.58-0.63	0.74	2/3
P6 outer set. / inner sp.		-	-	1.8	1.5-2.0	-	-	~2.0 -

outer one (Pesce and De Laurentiis, 1996); from this species *D. alticola* can be easily distinguished by a different length of furcal rami, different length ratio between Ti and Te, much shorter Sd, larger body size, more elongated P4enp3, and the presence of exopodal seta of antenna (Pesce and De Laurentiis, 1996).

Key to species of the genus *Diacyclops* Kiefer in Central Asia:

1. Endopodites of P1-P2 2-segmented 2
 - Endopodites of P1-P2 3-segmented3
2. Antennules 16-segmented*Diacyclops languidus* (Sars, 1863)
 - Antennules 11-segmented*Diacyclops languidoides* (Lillieborg, 1901)
3. Inner spine of Enp3P4 longer than outer spine;

antennules 17-segmented *Diacyclops bisetosus* (Rehberg, 1880)

- Inner spine of Enp3P4 shorter than outer spine 4
- 4. Antennules 17-segmented *Diacyclops bicuspoidatus* (Claus, 1957)
 - Antennules 14-segmented *Diacyclops odessanus* (Schmankevitch, 1875)
 - Antennules 12-segmented *Diacyclops alticola* Kiefer, 1935

Acknowledgements

Prof. D. Defaye (France) and Prof. G.L. Pesce (Italy) are thanked for helpful suggestions. Prof. Ranga Reddy (India) is thanked for help in providing necessary references.

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