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SHORT PAPER

First Record of the Genus *Phyllodiaptomus Kiefer* (Copepoda, Calanoida, Diaptomidae) from Turkey

Aysel Bekleyen[1,*], Bülent Gokot[1], Memet Varol[2]

[1]Dicle University,Department of Biology, Faculty of Science, 21280 Diyarbakır, Turkey.
[2]Inonu University, Department of Basic Aquatic Sciences, Faculty of Fisheries, Malatya, Turkey.

* Corresponding Author: Tel.: +90.412.2488550/3163; Fax: +90.412.2488300;
E-mail: aybek@dicle.edu.tr

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Abstract

The genus *Phyllodiaptomus* Kiefer, 1936 is reported from Turkey for the first time. *Phyllodiaptomus* sp. collected from the Batman Dam Reservoir in Southeastern Turkey was observed only between May and November 2008. The female and male specimens are illustrated in detail. *Phyllodiaptomus* sp. is closely related to *P. blanci* (Guerne & Richard) and *P. irakiensis* Khalaf, from which it differs in several characteristics that are discussed. The present new record extends the known distribution of the genus *Phyllodiaptomus* to Turkey being a natural bridge between Europe and Asia.

Keywords: Diaptomidae, Batman Dam Reservoir, Turkey.

Introduction

Currently the genus *Phyllodiaptomus* is represented by 11 valid species, distributing from east to west of Asia, except north of the continent. (Reddy, 1994; Sanoamuang and Yindee, 2001; Sanoamuang and Teeramaethee, 2006; Khalaf, 2008).

The first member of the genus was described by Guerne and Richard (1896) as *Diaptomus blanci* from shallow water bodies in the vicinity of Bukhara, Uzbekistan. Forty years later, Kiefer (1936) established the new genus, *Phyllodiaptomus* for *D. blanci* and *D. annae* Apstein from Sri Lanka because of their different generic features. Later, *P. tunguidus* Shen and Tai from China, *P. longipes* Kiefer from west Kalimantan (Indonesia), *P. sasikumari* Reddy and Venkateswarlu and *P. wellekensae* Dumont and Reddy from India (Reddy, 1994), *P. praedictus* and *P. christinae* (Dumont and Reddy, 1994; Dumont *et al*., 1996) from Thailand were described. Dumont *et al*. (1996) divided the genus into two subgenera, and included the four Asian species (*P. annae, P. sasikumari, P. wellekensae* and *P. praedictus*) to subgenus *Ctenodiaptomus* (the annae-group), and the remainder to subgenus *Phyllodiaptomus* (the blanci-group). Subsequently, three species belonging to the *blanci*-group were identified: *P. surinensis* and *P. thailandicus* from Thailand (Sanoamuang and Teeramaethee, 2006; Sanoamuang and Yindee, 2001) and *P. irakiensis* from Southern Iraq (Khalaf, 2008).

To date, no record of the genus *Phyllodiaptomus* has been reported from Turkey. In this study, the morphological characteristics of *Phyllodiaptomus* sp. is illustrated and, also, compared with closely related species of the genus.

Materials and Methods

Located between latitudes 38°09′34 and 38°11′15 N, and longitudes 41°01′41 and 41°15′30 E, The Batman Dam Reservoir has a surface area of 49.25 km^2 and a volume of 1175 hm^3 at 652 m above sea level. The Batman Dam was erected for hydroelectric power generation, irrigation and flood control in 1999. Its surface waters have temperature in 18-23^{o}C range, DO in 6.9–8.69 range, conductivity in 174–247 µS cm^{-1} range and pH in 8.2–8.8 range (Varol *et al*., 2012).

The samples were collected with 55 µm mesh plankton net and preserved in 5% formaldehyde solution. Identification based on the revisions of Kiefer (1978) and Reddy (1994) were carried out under an Olympus BX51 compound microscope. All figures were drawn using camera Lucida. The terminology mainly follows Kiefer (1978) and Reddy (1994).

Results and Discussion

To date, Subfamily Diaptominae in Turkey has

been represented with seven genera (*Acanthodiaptomus, Arctodiaptomus, Diaptomus, Eudiaptomus, Mixodiaptomus, Occidodiaptomus* and *Sinodiaptomus* (Ustaoğlu, 2004, 2015), and now the genus *Phyllodiaptomus* is aided to this group as eighth genus. With the present new record, the distribution known of the genus *Phyllodiaptomus* extends to Turkey which is a natural bridge between Europe and Asia. The morphological characteristics of *Phyllodiaptomus* sp. were illustrated in Figure 1 and Figure 2. The Turkish population of the genus *Phyllodiaptomus* is more closely related to *P. blanci* in many morphological features (see Reddy and Devi, 1990; Reddy, 1994). However Turkish population differs from *P. blanci* in the following features: in female, the left wing of fifth pediger with two overlapping lobes of different size (Figure 1a), which can be observed in only *P. irakiensis* (Khalaf, 2008); shorter sensory seta on the basis of Leg 5 (Figure 1b), pointed coxal spines of Leg 5; in male, a distinct knob near the base of the right rostral spine of the male (Figure 2a) which is absent in the remaining members of the genus, except for *P. thailandicus* (Sanoamuang and Teeramaethee, 2006); anal somite together with caudal rami conspicuously bent to right side that is observed in only *P. irakiensis* (Khalaf, 2008).

A critical comparison shows that *Phyllodiaptomus* sp. is also closely related to *P. irakiensis* in the following features: two overlapping lobes of different size on the left wing of fifth pediger in the female (Figure 1a), anal somite together with caudal rami conspicuously bent to right side in the male, and a row of small hyaline spines on second exopodite segment of the male. However, our specimens differ from *P. irakiensis* in following characters: in the male, bifid setae on segments 14–17 and one spine on segment 12 of the right antennule (Figure 2b); spinous left metasomal wing; second exopodite segment of right Leg 5; the endopodite of left Leg 5; second urosomite with ventral hairs; in female (Figure 1a, b), the sensory seta on the basis of Leg 5; third exopodite segment of the Leg 5; hyaline lobes on the second and third urosomal somites (Khalaf, 2008).

P. blanci and *P. irakiensis* are the westernmost species of the genus (Marrone *et al*., 2014; Reddy, 1994). Probably, *Phyllodiaptomus* sp. in Turkey is one of the geographic variations of *P. blanci* or a new species of the genus. It is evident that *Phyllodiaptomus blanci* needs detailed systematic revision covering its regional differences, also based on molecular analyses.

During a monitoring program conducted between February 2008 and January 2009 in the Tigris River Basin (the Southeastern Turkey), *Phyllodiaptomus* sp. was abundantly found in only the Batman Dam Reservoir. Although another diaptomid copepod, *Acanthodiaptomus denticornis* was abundantly found in other two dam reservoirs (Kralkızı and Dicle) within the river basin in the same period, it was absent in Batman Dam Reservoir where any calanoid copepod other than *Phyllodiaptomus* sp. was also not observed. Indeed, only two species of calanoid copepods (*A. denticornis* and *Sinodiaptomus sarsi*) have, hitherto, been reported from the Tigris River basin of the Southeastern Turkey (Ustaoğlu, 2004). Thus, it seems unclear whether *Phyllodiaptomus* sp. in Turkey is non-indigenous invader species. We estimate that *Phyllodiaptomus* sp. transported via an unknown canal has established its population and then invaded the reservoir in time. But we do not know if other calanoid copepods have previously lived in this lake because this is the first study on the zooplankton of the lake. There is no

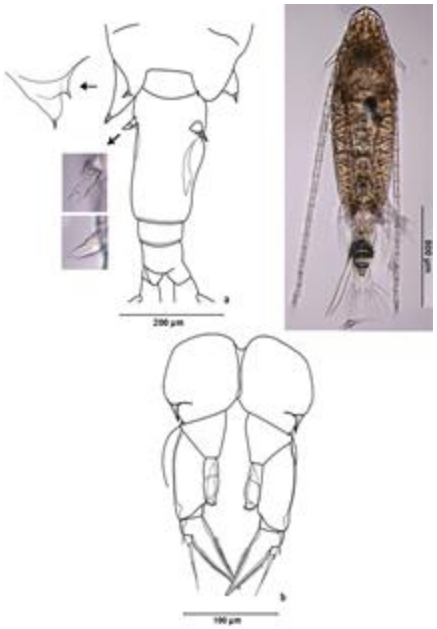

Figure 1. *Phyllodiaptomus* sp. from Turkey, female; a. metasomal wings and urosome, b. fifth leg.

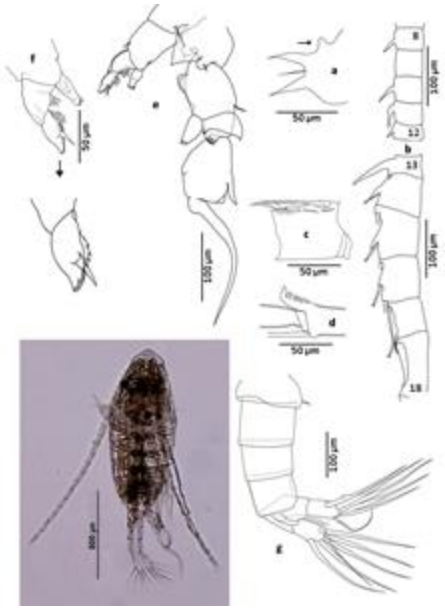

Figure 2. *Phyllodiaptomus* sp. from Turkey, male; a. knob near base of right rostral spine (dorsal); b. segments 8–18 of right antennule, c. segment 17, d. comb-like process on antepenultimate segment, e. fifth leg, f. Exo and endopodite of left fifth leg, g. urosome and caudal rami.

doubt that life conditions of the lake seem to be favourable enough to permit survival and reproduction of the present population. Most recently, Marrone et. al. (2014), who reported the first record of *P. blanci* from the man-made pond in Israel, also put forward that *P. blanci* might be an allochthonous or an alien species in Israel. Consequently, it is necessary and crucial to monitor the present population in Turkey considering such a possibility.

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