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STUDIES ON INDIAN CALANOIDS I. DESCRIPTION OF A NEW CALANOID COPEPOD, *NEODIAPTOMUS TIWARII* SP. NOV. (CALANOIDA : DIAPTOMIDAE) FROM THE NILGIRI DISTRICT WITH ECOLOGICAL OBSERVATIONS.

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ABSTRACT

A new species of the genus *Neodiaptomus* Kiefer was described and figured from the Nilgiri District in South India. Affinities with previously described species of the genus, discussed. Brief ecological observations of verious water bodies in relation to the species described, have been incorporated.

INTRODUCTION

So far, the following nine species of the genus *Neodiaptomus* Kiefer have been described : *N. schmackeri* (Poppe & Richard, 1892) (=*D. strigilipes* Gurney, 1907 ; =*D. handeli* Brehm, 1921) ; *N. meggitti* Kiefer, 1932) ; *N. lymphatus* Brehm, 1933 ; *N. mephistopheles* Brehm, 1933 ; *N. physalipus* Kiefer, 1935 ; *N. diaphorus* Kiefer, 1935 ; *N. lindbergi* Brehm, 1953 ; *N. satanas* Brehm, 1953 and *N. kamakhiae* Reddiah, 1964.

Kiefer (1939) reported six species out of which four of them *N. schmackeri*, *N. meggitti*, *N. lymphatus* & *N. mephistopheles* were recorded from China, Burma, Celebes and Java respectively. The remaining two species *N. physalipus* and *N. diaphorus* along with the three more species, *N. lindbergi*, *N. satanas* and *N. kamakhiae* were recorded from eastern and southern India.

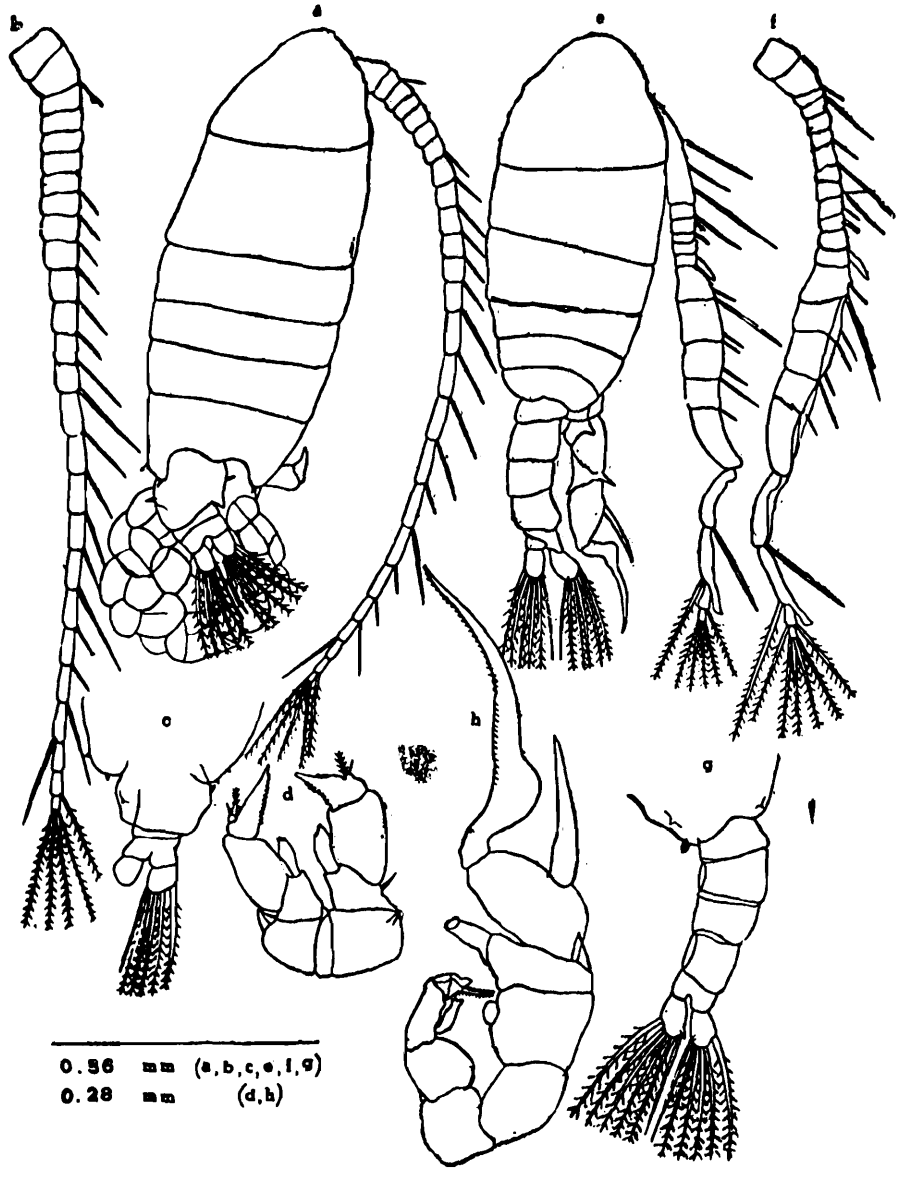
A careful examination of the material of the Calanoid Copepods collected during Nilgiri District Faunistic Survey by the Zoological Survey of India in January-February, 1971, from 18 localities of which 8 localities, revealed the presence of a tenth and new species of *Neodiaptomus* Kiefer.

MATERIAL AND METHODS

The field work and laboratory study for preliminary identification was carried out while the author was holding a fellowship of the Zoological Survey of India, Calcutta.

The collections were made by the author with the help of 29 cm diameter conical (0.5 mm to 1.0 mm mesh size) plankton townet for about fifteen minutes in each haul and the pH measurement was made by the Litmas paper. The specimens of all localities were preserved in 85% Ethyl alcohol (C_2H_5OH) including 2/3 drops of Glycerine. Detail of the material examined has been given under the systematic account of the species described.

This communication is a part of my thesis submitted for the Award of Ph.D. degree in the Calcutta University (1980).



Neodiaptomus tiwarii sp. nov.

Fig. 1. (a—h), a—d, adult female ; e—h, adult male

a.	Adult female	dorsal view
b.	" "	antennule
c.	" "	urosome with last thoracic segment
d.	" "	fifth pair of legs
e.	" male	dorsal view
f.	" "	right antennule
g.	" "	urosome with last thoracic segment
h.	" "	fifth pair of legs

The specific name of the new species *tiwarii* is dedicated in honour of Dr. K. K. Tiwari, a renowned carcinologist of India, as a tribute to his untiring efforts towards the development of the carcinological research in the Zoological Survey of India, Calcutta.

Neodiaptomus tiwarii sp. nov.

(Fig. 1 a-d, adult female ; e-h, adult male)

Material : Holotype : Adult female, Nullah (below culvert) near Wellington Military Barracks, 5 kms, up from Coonoor town on way to Ootacammund, Tamilnadu, India, 27.1. 1971 (T. Roy Coll.), Regd. No. C 2546/2. Allotype : Adult male, with same data as the holotype, Regd. No. C. 2547/2. Paratypes : 119 females and 84 males with the same data as the holotype, Regd. Nos., C 2548-49/2. All the specimens including non types have been deposited in the National Collections of the Zoological Survey of India, Calcutta.

Description of the adult female :

The total length of the body (Fig. a) excluding the caudal setae is 1.16 mm. The average length of the species is 1.10 mm range : 1.06 mm to 1.20 mm based on the measurement of five specimens. The body is more cylindrical with six divisions of the prosome and three divisions of the urosome (Fig. c). The wings of the last thoracic segment are asymmetrical and has two lobes. Each lobe is possessing two small spines. The spines of the right lobe are more closer than the left lobe. The proportional length of the prosome and the urosome are as follows :

$$78 : 22 = 100$$

The genital segment (Fig. c) is the largest segment and the second segment is the smallest. The middle of the both inner and outer margin of the genital segment is little swollen and each bears a small spine pointing laterally. The proportionate length of the urosomal segments are as follows :

$$\text{Segments } \frac{-1 \quad -2 \quad -3 \quad \text{caudal rami}}{50 \quad 9 \quad 18 \quad 23} = 100$$

Caudal rami (Fig. c) are symmetrical. Each ramus bears six caudal setae. The innermost naked caudal seta is thin and short and has a small sclerotised knee a short distance from the base. The other five setae are equal in length and are crowded with fine setules in plumose fashion.

The first antennule :

When it (Fig. b) folds back to the body, the tip of the antennal setae reaching a little beyond the tip of the caudal setae. It consists of 26 segments. The setal arrangement in the antennule are as shown in the figure. The proportionate length of segments are given below :

$$\text{Segments } \frac{1 : 2 : 3 : 4 : 5 : 6 : 7 :}{48 \quad 54 \quad 25 \quad 25 \quad 25 \quad 25 \quad 25}$$

$$\frac{8 : 9 : 10 : 11 : 12 : 13 : 14}{28 \quad 31 \quad 34 \quad 41 \quad 41 \quad 38 \quad 38}$$

$$\frac{15 : 16 : 17 : 18 : 19 : 20 :}{56 : 47 : 50 : 47 : 53 : 33}$$

$$\frac{21 : 22 : 23 : 24 : 25 : 26}{49 : 49 : 50 : 38 : 31 : 19} = 1000$$

Fifth leg :

Fifth leg (Fig. d) is symmetrical. It consists of two pairs of basipod, two pairs of exopod and one pair of endopod segments.

The right fifth leg :

It consists of two basipod two exopod and one endopod segments. The first basipod segment is large and nearly circular and it possesses a strong spine on its dorsolateral region of the outer margin. The second basipod segment is smaller than the first basipod segment and is ornamented with a small seta on its outer margin. The first exopod segment is large, cylindrical and

unornamented. The second exopod segment forms claw and is knobbed at its base. It has a knotch on its outside from which two unequal setae arise. The inner margin of the claw is set with seven to eight highly chitinised and conical teeth out of which three are larger and four to five are smaller. The outer margin of the claw is set with five to six small highly chitinised and thick denticles. The endopod arises from the dorsolateral corner of the inner margin of the second basipod segment and is fringed with fine hairs at its tip.

The left fifth leg :

The left fifth leg (Fig. d) is similar to the right in many respects except in the sizes of the second basipod, first and second exopod segments (Claw) and the nature of denticulation of the claw. The size of the endopod of the left leg is little smaller than that of the right.

Description of the adult male :

The total length of the body (Fig. e) excluding the caudal setae is 1.12 mm. The average length is 1.11 mm (range : 1.10 mm to 1.13 mm based on the measurement of five specimens). The body is more cylindrical and with six divisions of the prosome and five divisions of the urosome. The head fused with the first thoracic segment. The anterior region of the body is little compressed. The wings of the last thoracic segment are asymmetrical. Each wing bears two small spines. The proportionate length of the cephalothorax and the urosomal segment are as follows :

67 : 33=100

The urosome (Fig. g) consists of five segments. The second segment is the largest and the anal segment is the smallest. The caudal rami are symmetrical. Each ramus bears six caudal setae. The innermost caudal seta is short and thin and has a sclerotised knee a short distance from the base. The ramaining five caudal setae are equal in length and fringed with fine setules in plumose fashion.

Right anterior antennule :

When the prehensile right anterior antennule (Fig. f) folds back to the body, the tip of the antennal setae reaching almost the tip of the caudal setae. It consists of 22 segments. The proportionate length of the segments are as follows :

Segments	1	2	3	4	5	6	7
	44	51	18	22	29	26	37
	8	9	10	11	12	13	14
	22	26	29	18	29	29	55
	15	16	17	18	19	20	21
	51	66	51	118	118	102	37

$\frac{22}{22}$:=1000

Segments 10 and 11 bear small spines while the segment 13 possesses the longest, stoutest and highly chitinised spine. The terminal process of the antepenultimate segment is straight and slightly broad at its tip with little recurved distally. The setae of the ultimate and penultimate segments are fringed with fine setules.

Fifth leg :

Fifth leg (Fig. h) is well built and asymmetrical. The tip of the left leg reaching almost the distal end of the first exopod segment of the right leg. It consists of right and left fifth leg.

The right fifth leg :

It consists of two basipod, three exopod and one endopod segments. The first basipod

TABLE 1. Frequency distribution of the catch composition of *Neodiaptomus tiwarii* sp. nov., indicating the sex ratio within the species and occurrence of other Cyclops.

	Nullah (below culvert) near Wellington Military Barrack, Coonoor.	Reservoir near Ralliah Dam, Coonoor.	Nursery pond (A) in the Wilson Fish Farm, Ootacammund.	Nursery pond (B) in the Wilson Fish Farm, Ootacammund.	Nursery pond (C) in the Wilson Fish Farm, Ootacammund.	Reservoir near pykara Dam, Ootacammund. * * *	Kamraj Sagar Reservoir, Ootacammund.	Ootacammund Lake, Ootacammund. * * *
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Date	27.1.1971	27.1.1971	2.2.1971	2.2.1971	5.2.1971	3.2.1971	3.2.1971	5.2.1971
No. of females	122 ; 3D*	226 ; 5D*	94 ; 1D*	80 ; 1D*	4 ; 1D*	56 ; 4D*	6 ; 1D*	8 ; 2D*
(i) ** Range (mm) based on 5 specimens	1.12-1.18	1.14-1.16	1.13-1.17	1.14-1.16	1.13-1.16	1.15-1.18	1.13-1.16	1.14-1.17
(ii) Mean (mm)	1.15	1.16	1.15	1.16	1.15	1.17	1.14	1.16
No. of males	88 ; 3D*	209 ; 5D*	27 ; 2D*	38 ; 1D*	1D*	48 ; 2D*	2 ; 1D*	1D*
(i) **Range : (mm) based on 5 spsci-mens	1.10-1.14	1.10-1.15	1.09-1.12	1.10-1.12	—	1.10-1.14	1.08-1.10	—
(ii) Mean (mm)	1.12	1.13	1.10	1.10	1.11	1.13	1.09	1.10
No. of immatures	1	3	—	—	—	3	—	—
Other Cylclops	—	—	13	7	39	10	9	12

*D = Dissected ; **Range = Total length of the body excluding caudal setae ; *** = From the water bodies, author collected the new species and no other diaptomids except Cyclops.

segments. is nearly circular and unornamented. The second basipod segment is larger than the first and has a prominent hyaline tubercle near the middle of the inner margin. The first exopod segment possesses a strong spine on its dorso-lateral region of the outer margin and a small protuberance on its inner margin. The second exopod segment is cylindrical and a strong spine which is almost the equal in length of the second exopod segment, originating from the middle of the outer margin of the segment. The third exopod segment forms claw and its bends and tapers to a blunt end. The inner margin of the claw is striated. The base of the claw which is a little distance from the proximal region is knobbed posteriorly. The endopod is small and cylindrical originating from the dorsolateral region of the inner margin of the first exopod segment and is fringed with fine hairs at its tip.

The left fifth leg :

It consists of two basipod, two exopod and one endopod segments. The first basipod segment is almost equal in size of the basipod of the right fifth leg. The second basipod segment is smaller than its counter part of the right leg. The first exopod is longer than the wide and cylindrical and the inner margin of segment is smaller than the first. The third exopod segment is represented by a strong and short spine and long serrated seta. The endopod is small and narrow and is little wider at its base and is fringed with fine hairs between the two spinnules at its tip.

REMARKS

New species differs from *N. schmackeri* in the size and shape of the genital segment of the female and in the shape and structure of the claw and the endopod of the male right fifth leg. It also differs from *N. meggitti* in the shape and structure of the female genital segment. New species differs from *N. lymphatus* and *N. mephistopheles* in the absence of serrations on the process of the antepenultimate segment of the right antennule of the male. New species differs from *N. physalipus* and *N. diaphorus* in wider than long in the genital segment and in the shape and denticulation of the claws of the fifth leg of female. In the male, though similar in shape of the claw but it differs in size of the claw and the endopod of the male right fifth leg. New species differs from *N. lindbergi* in the size of the females and in the ornamentation at the tip of the endopods of the female fifth leg. It also differs in the position and length of the lateral spine of the second exopod segment and in the shape of the endopod of the male right fifth leg. *N. satanas* differs from the new species in having the extremely thin nature of the claw of the male right fifth leg. It also differs in having a small lateral process at the outer distal corner in addition to the small and curved lateral spine of the second exopod segment of the male right fifth leg. Further, is also differs in having the serrated process of the antepenultimate segment of the right antennule of the male. New species differs from *N. kamakhiae* in the size and structure of the genital segment and in the structure and denticulation of the claws of the female fifth leg. In the male, it differs in the shape of the claw and in the size and position of the lateral spine of the second exopod segment of right fifth leg.

N. tiwarii differs from all species in the size and shape of the genital segment of the female and in the structure and degree of denticulation of the claw of the female fifth

leg. In the male, it differs in the size of the endopod and in the size and position of the lateral spine of the second exopod segment of the right fifth leg.

Ecological Observations

Ecological observations were made from the following localities where the new species was encountered :

i) Nullah (below culvert) near Wellington Military Barracks (formerly known as Jakatalla Barracks), 5 kms. up from Coonoor town on way to Ootacammund on 27.1.1971 ; Adult abundant, many females ovigerous and with attached spermatophores ; single immature ; some vegetation ; cool and unclean water ; temperate (9°C)* ; pH-neutral ; 3 males and 3 females dissected.

ii) Large reservoir near Ralliah Dam, 11 kms. from Coonoor town on 27.1.1971 ; Adult abundant, many females ovigerous and with attached spermatophores ; very few immature ; no vegetation ; Cool and clean water, temperate (9°C)* ; pH-neutral ; 5 males and 5 females dissected.

iii) Nursery ponds (A, B & C) in the Wilson Fish Farm in Ootacammund on 2.2.1971 and 5.2.1971 Adult abundant, associated with other Cyclops ; some vegetation ; cool and unclean water, temperate (1°-2°C)* ; pH-neutral ; 4 males and 3 females dissected.

iv) Large reservoir near Pykara Dam in Ootacammund on 3.2.1971 ; Adult abundant, many females ovigerous and with attached spermatophores ; few immature associated with other Cyclops ; no vegetation ; cool and clean water ; temperate (1°C)* ; pH-neutral ; 2 males and 4 females dissected.

v) Kamraj Sagar reservoir in Ootacammund on 3.2.1971 ; very low population probably due to the effect of effluents of nearby the Hindustan Photo Films Factory and other small factories ; no vegetation ; cool and unclean water, temperate (1°C)* ; pH-acedic ; 1 male and 1 female dissected.

vi) Ootacammund Lake near P. W. D. Bunglow 0.8 km. from Ootacammund Railway Station on 5.2.1971 ; Adult very few associated with other Cyclops ; phytoplankton blooms with leaves and branches of trees ; cool and unclean water, temperate (2°C)* ; pH-acedic ; 1 male and 2 females dissected.

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*The figure in the parenthesis indicates the atmospheric temperature at the time of collections.

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