

A CRITICAL REVIEW OF THE CENTROPAGID GENUS
ISIAS BOECK (COPEPODA: CALANOIDA) FROM INDIAN ESTUARIES

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ABSTRACT

Comparatively very little attempt has been made to study the morphological features and interrelationships of the centropagid genera occurring in the Indian estuaries. The genus *Isias* Boeck is closely allied to *Centropages* Kroyer, but shows phylogenetic divergence in some taxonomic characters. Upto now, only three species have been described under the genus, viz. *I. clavipes* Boeck and *I. tropica* Sewell from the northern hemisphere and *I. uniceps* Bayly from the southern hemisphere. In the present communication a critical review of the morphological peculiarities of the species of *Isias* in the tropical environment has been discussed. The description of a new species of *Isias* collected from the estuarine area in the Cochin Backwater is also included.

INTRODUCTION

Practically very little attention has been paid to study the morphological peculiarities and phylogenetic relationships of the planktonic copepods of Indian waters that have been able to adapt themselves to a brackish or even a freshwater habitat. One of the best examples of the spread of the marine copepods into brackish and finally freshwater habitats, and subsequent evolution of new species is to be found in the calanoid copepod family Centropagidae. Of the various genera of this neritic family, *Isias* Boeck is interesting as it occupies an ecologically intermediate position between the genus *Centropages* and other freshwater genera assigned to the family Centropagidae. The genus *Isias*, established by Boeck (1864), was placed under the subfamily Temorinae by Giesbrecht (1889). As this genus evinced close relationships in some morphological features to the genus *Centropages* than to any genus of the subfamily, Sars (1903) removed it from Temorinae and placed it under the family Centropagidae. Todate, only three species have been described under this genus, viz. *Isias clavipes* Boeck (1864 : North Atlantic and its offshoots; North Sea and Mediterranean) and *I. tropica* Sewell (1924 : Chilka Lake, Orissa Coast, India) from the Northern hemisphere and

I. uniceps Bayly (1964: Brisbane River Estuary, Australia) which is the only representative of this genus from the southern hemisphere.

No revisional study of this genus has been carried out from the Indian waters so far. Since its original description (Sewell, 1924), *I. tropica* was not recorded from anywhere until Kasthurirangan (1963) collected it from the Cochin Backwater. During the present study a few adults and copepodid stages belonging to this genus were encountered in the surface zooplankton samples collected from the Cochin Backwater during February, 1968 and as the material differs from the descriptions of all the known species of *Isias* it is reported here as new to science.

Only little is known about the morphological relationships of the estuarine centropagid genera occurring in Indian waters. The present report also embodies the results of a study on the structural details of *Centropages* - *Isias* series based on material collected from the estuarine waters around Cochin.

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GENUS *ISIAS* BOECK FROM INDIAN ESTUARIES

Isias Boeck, 1864

Diagnosis:

Cephalon anteriorly vaulted above; T-IV and T-V fused together; Female and male left A-1 of 23 segments; distal setae of Mx-2 poorly developed; Ri of P5 one-segmented and vestigial; Re of male P5 two-segmented, distal joints spatulate; that of right longer than that on left; Ri of P5 one-segmented and often asymmetrical.

Genotype: *Isias clavipes* Boeck, 1864

: From Karmo, west coast of Norway.

Species from Indian estuaries:

1. *Isias tropica* Sewell, 1924

(Fig. 1 q)

Isias tropica Sewell, 1924, pp. 782-783, pl. XLIV, Fig. 1

(Type locality: 19°45'N., 85°30'E., Chilka Lake, Orissa Coast, India)

Female: TL = 1.26 mm; P: UR ratio = 2.2:1

Male: TL = 1.16 mm;

Remarks:

Female and male of this species have been described by Sewell based on material from Chilka Lake. A-1 of female has been described to contain 22 segments, fusion having taken place between 8-9, 11-12 and 24-25 segments respectively. However, in *I. clavipes* and *I. uniceps* 24 segments are reported. Sewell (1924, p. 782) also observed that Re of A-2 of *I. tropica* resembled that of *I. elavipes*, which had been described to possess only five segments (Sars, 1903). In different species of *Centropages* and *I. uniceps* seven distinct segments are recorded.

An examination of the two Paratypes (No. C. 540) at Indian Museum, Calcutta, by the author revealed that a distinct mid-dorsal hump is present in both sexes of *I. tropica* although there is no mention of it in the description of the species by Sewell. The Paratypes agreed in all other details mentioned by Sewell.

According to Sewell (1924), *I. tropica* is a typical inhabitant of the littoral waters of the sea and has been brought into the Chilka Lake by the inflowing sea water. He recorded the specimens during February to April. However, Kasthurirangan (1963) observed this species 'in Cochin Harbour waters in 1956-'57 during the monsoon months', when the prevailing salinity values were very low and the surrounding waters became practically fresh. In the light of the previous records of the distribution of *Isias*, which have firmly established that it does not penetrate into freshwater, the record of this species from Cochin Backwater during monsoon months by Kasthurirangan (1963) is doubtful.

2. *Isias cochinensis* sp. nov.

(Fig. 1 a-p)

Material Examined:

Seven females and 8 males from the surface plankton samples collected from the Cochin Backwater during February, 1968, between 06.00 and 08.00 Hrs

Type material:

Holotype, Reg. No. CMFRI-204/2, Female, 1.27 mm and *Allotype*, Reg. No. CMFRI-204/2, Male, 1.19 mm collected from the Cochin Backwater on 20 February, 1968, from surface, 06.00 and between 08.00 Hrs; *Paratypes*, Reg. No. CMFRI-204/3, five females and five males collected from the Cochin Backwater as above. Type specimens are deposited in the Reference Collection Museum of the Central Marine Fisheries Research Institute.

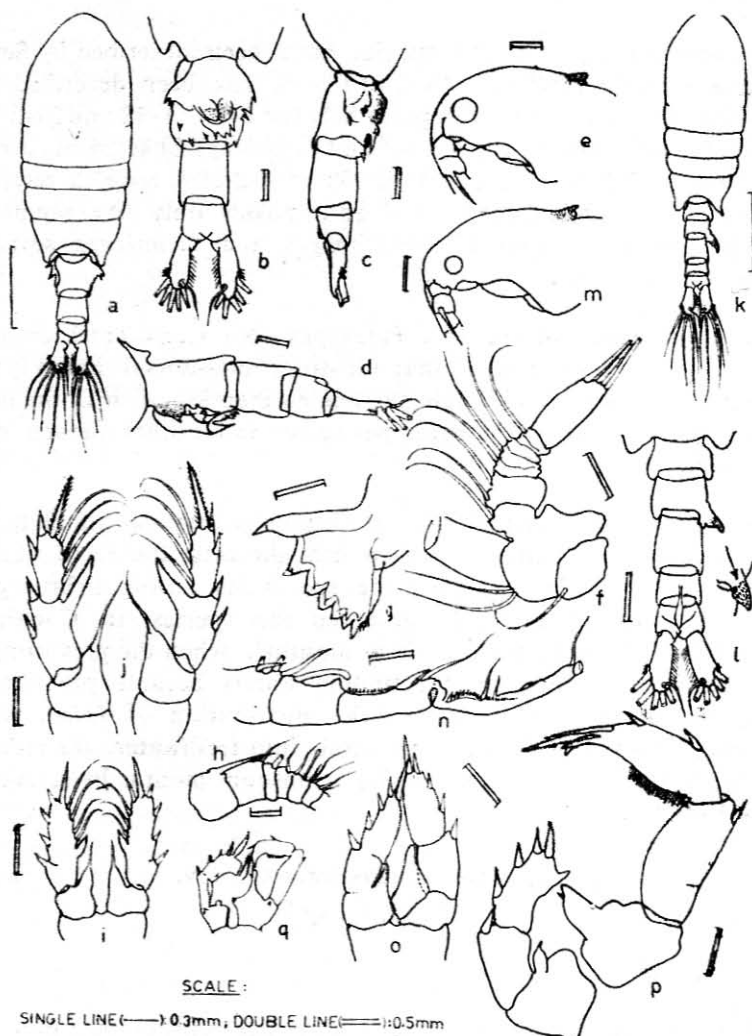


Fig. 1. *Isias cochinensis* sp. nov. a. Female, dorsal view; b. female, urosome, dorsal view; c. female, urosome, right lateral view; d. female, urosome, left lateral view; e. female, cephalon, lateral view; f. A-2; g. Mnd; h. A-1, segments 1-6; i. C-V, female P5; j. Adult, female P5; k. Male, dorsal view; l. Male, urosome, dorsal view; m. male, cephalon, lateral view; n. male, geniculate A-1, part enlarged; o. C-V, male P5; p. Adult, male P5; q. *Isias tropica* Sewell, male P5.

Size and body proportions:

	No.	Range (mm)	Mean (mm)	P : UR ratio
Adult female :	7	1.19-1.33	1.28	1.95:1
Adult male :	5	1.18-1.27	1.22	1.50:1

Description: HOLOTYPE: Cephalon and T-I fused; T-IV and T-V indistinctly fused, the line of separation feebly visible laterally; antero-medially, cephalon with an eye spot pigmented red; a distinct mid-dorsal hump present at junction of cephalon and T-I; posterior margin of T-V produced on either side into two distinctly rounded processes, tip reaching to one-fourth length of genital segment; urosome three-segmented, with CR having the following proportionate lengths: U-I = 34%; U-II = 28%; U-III = 16%; CR = 22%; genital segment longest and dorsally with irregular lateral margins; ventral plate of genital segment extensive and its lateral margins visible in dorsal view; ventrally genital segment is situated on a genital boss, which is laterally and posteriorly protected by a curved plate; left margin of ventral plate with three spines and right margin with four spines directed latero-posteriad; ventral margin of plate provided with four spines directed posteriad; in lateral view, median spines on posterior margin of ventral plate appears as prominent structure directed posteriad; U-II longer than broad; anal segment as long as broad; CR nearly three times as long as broad but asymmetrical, left ramus being slightly broader; on outer margin proximal to the point of origin of fifth apical seta each ramus is armed with a row of three to four needle-like spines; A-1 of 23 segments, reaching to middle of U-II; segments 8 and 9 fused, a distinct spine arising from disto-dorsal margin of first segment; Re of A-2 distinctly seven segmented with the setal formula = 1:3:1:1:1:0:3:0; Mnd with apical and subapical teeth well developed and acute, four median teeth bluntly pointed and basal tooth enlarged and with few needle-shaped spinules ventrally; other cephalic appendages resemble those of *I. clavipes*; setae and spines on P1 to P4 are presented in Table I; P5: Re two-segmented, Re1 and Re2 fused; Re1 with two outer marginal spines and a large distal inner curved spine serrated at its lateral margins; Re2 with two outer marginal spines, a serrated end spine and four delicate inner marginal setae; outer margin of Re2 and proximal outer margin of Re1 setose; Ri rudimentary, and fused with B2 appearing as a conical projection, terminally provided with a long seta.

ALLOTYPE (1 Male): Prosome resembles that of female; lateral T-V margins not projected as in female; urosome five-segmented, with CR having the following proportionate lengths: U-I = 13%; U-II = 20%; U-III = 21%; U-IV = 12%; U-V = 11% and CR = 23%; U-II with a well developed blunt

projection on its right distal corner, directed latero-posteriad; Right *A-1*: geniculate and with 22 segments, reaching to U-III; dorsal margins of segments 15 and 16 carry spines; segment 17 with a dorsal proximal spine serrated at its inner margin and curved at its tip; segment 18 and proximal half of fusion segment 19-20 with denticulated plate on their dorsal margin; a small spine present on the proximal corner of segment 19; P5: asymmetrical; each leg consists of two-segmented Re and rudimentary Ri; right leg: B2 with a rounded finger-like process carrying a small spine at apex- the Ri; Rel with a disto-lateral spine; Re2 with three outer lateral spines and a long terminal spine; there is a distinct peg-like projection at the inner distal margin of Re2; inner margin of the segment emarginated; left leg: B2 with a semi-conical Ri, rounded at tip and with a subterminal notch carrying a small spinule; Re 1 elongated and with a disto-lateral spine; Re2 with two outer marginal spines and sub-terminally at outer distal corner with two long spines of which inner one is warty; inner distal corner of segment produced as a finger-like projection, apex of which is bilobed.

COPEPODITE - V: Few specimens of C-V stage, belonging to this species were also collected from the estuary. Distinct sexual differentiation was observed in the *A-1* and P5. Right *A-1* of male with a non-extensive, dorsal spinous process on segments 18 and 19; Female P5: Re one-segmented, with four outer marginal spines, one terminal spine, four inner marginal setae and one stout inner marginal spine; Ri resembles that of the adult. Male P5: Re two-segmented and asymmetrical, right Re larger; Rel with a distal outer marginal spine; terminal segment of Re with four spines; Ri asymmetrical, right Ri larger.

REMARKS:

Isias cochinensis is closely related to *I. tropica* Sewell and *I. clavipes* Boeck and differs markedly from *I. uniceps* Bayly which is known only from the southern hemisphere. The male fifth legs of these four species share the following features in common: both Re are vestigial and have a single outer spine on the proximal segment; both the Ri are vestigial; the right distal Re segment bears four main spines, two of which are outer lateral and two terminal. In *I. cochinensis* B2 of P5 has a simple more or less conical Ri; but in *I. tropica* Ri has a recurved claw and in *I. clavipes* a conical process with a spine at its base. The inner distal margin of Re2 has a peg-like projection in *I. cochinensis* while in *I. tropica* and *I. clavipes* the margin is bulged but smooth. In these three species, the Ri of female P5 is one-segmented. However, the female of the new species differs from that of *I. tropica* and *I. clavipes* in having a short and conical Ri. Other features which distinguish the new species from *I. tropica* are: (1) nature of the

spinous plate and its ornamentation on the ventral and posterior margin of genital segment, and (2) second urosomal segment of the male *tropica* has been described to have a small rounded projection on its right margin covered with small spines, whereas, in the present species the process is finger-like, projecting laterally and devoid of spinules.

KEY TO THE SPECIES OF THE GENUS *ISIAS* BOECK

1. Female genital segment extended posteriorly, overlapping U-II; genital aperture displaced to the right margin; male, without the right lateral marginal process on urosome; male fifth leg with the vestigial endopodal process in the form of a large hook, longer than the combined lengths of Re1 and Re2 2
 Female genital segment projects laterad, genital aperture ventrally placed; male with a distinct process on the right margin of second urosomal segment or third urosomal segment; male fifth leg with the vestigial Ri in the form of a short, blunt process 3
2. Process along inner margin of the exopod of female fifth leg relatively large *uniceps* Bayly (Australia)
 Process along inner margin of the exopod of female fifth leg relatively short 3
3. In female fifth leg, exopod three-segmented; in male, abdominal process present on third urosomal segment *clavipes* Boeck (Norway Coast)
 In female fifth leg, exopod two-segmented; in male, abdominal process present on second urosomal segment 4
4. Exopod of male fifth leg simple conical structure without the recurved claw *cochinensis* sp. nov (Cochin Backwater)
 Exopod of male fifth leg strongly developed, with distinct recurved claw *tropica* Sewell (Chilka Lake, India)

It is evident that *I. cochinensis* does not penetrate into the less saline water of the estuary as the examination of the samples collected from different areas with salinity gradients towards the head of the estuary during the same

Table-I. Comparison of the characters of certain appendages in *Centropages* with those of different species of *Isias*

	A-1 Segments	Re Segments of A-2	PI		P2, P3		P4		P5	
			Ri	Re	Ri	Re	Ri	Re	Ri	Re
<i>Centropages</i>	24	6-7	1+2+6	I.1+ I.1+ II.1.4	1+2+8	I.1+ I.1+ III.1.5	1+2+7	I.1+ I.1+ III.1.5	1+1+6	I.II+ II.1.4
<i>I. clavipes</i>	24	5	1+2+5	I.1+ I.1+ II.1.4	1+2+8	I.1+ I.1+ III.1.5	1+2+7	I.1+ I.1+ III.1.5	1+2+1	II.1+ II.1.4
<i>I. uniceps</i>	24	7	1+2+6	I.1+ I.1+ II.1.4	1+2+7	I.1+ I.1+ III.1.5	1+2+6	I.1+ I.1+ III.1.5	1+3+2	I.II+ II.1.4
<i>I. cochinensis</i>	23	7	1+2+6	I.1+ I.1+ II.1.4	1+2+8	I.1+ I.1+ III.1.5	1+2+7	I.1+ I.1+ III.1.5	0+1+0	II.1+ II.1.4
<i>I. tropica</i>	22	5?	—	—	—	—	—	—	0+1+0	II.1+ II.1.4

period (29.80 to 16.31‰) does not contain any specimen. It occurred in surface tows from the Cochin Backwater where the mean surface salinity was 29.80 ‰ and mean temperature 28.9°C.

An interesting parallel can be drawn between the season of occurrence of the three species of this genus as follows:

	<i>Latitude</i>	<i>Period of occurrence</i>
<i>Isias tropica</i>	19°45'N.	February to April (Sewell, 1924)
<i>I. uniceps</i>	27°S.	July to September (Bayly, 1964)
<i>I. cochinensis</i>	09°58'N.	February (Present collection)

A comparison of the structural features observed in the genus *Centropages* with those of *I. tropica* and *I. cochinensis* shows minor differences in the ornamentation of the male and female fifth legs and segmentation of antennule (Table I). Distal setae of second maxilla are well developed in *Centropages* while these are poorly formed in *Isias*. These differences are stronger in the northern hemisphere species (*I. clavipes*, *I. tropica* and *I. cochinensis*) than in *I. uniceps* recorded from the Australian Estuary. At present our knowledge regarding the phylogenetic relationship of *Centropages* and non-marine centropagid genera is sparse. However, there is evidence to the fact that the successive occupancy of the ecological series by copepods (such as from marine to brackishwater) is characterised by reduction in certain morphological characters.

REFERENCES

- Bayly, I. A. E. 1964 A new species of *Isias* (Copepoda: Calanoida) from the Brisbane River Estuary, a comparison of the Australasian centropagid genera. *Aus. J. Mar. Freshw. Res.*, 15 (2), 239-247.
- Boeck, A. 1864 Oversight over de ved Norges Kyster iagttagnecopepoder, henhorende till Calaniderness, Cyclopiderness og Harpactiderness *Familier. Vidensk. Selsk. Forhandl. Christiania*, 226-282.
- Kasthurirangan, L. R. 1963 A key for the identification of the more common planktonic copepods of Indian coastal waters. *INCOR Publ.*, 2, 1-87, 93 figs.

- Sars, G. O. 1901-1903 An account of the Crustacea of Norway.
4. Copepoda Calanoida. Pts. 1, 2, pp. 1-28,
pls. 1-16 (1901); pts. 3-12, pp. 29-144, pls.
17-96 (1902); Pts. 13, 14, pp. 145-171, pls.
97-102 and suppl. (1963) pls. 1-6, Bergen.
- Sewell, R. B. S. 1924 Fauna of Chilka Lake. Crustacea: Copepoda.
Mem. Ind. Mus. 5, 711-851.