

—ON *CANDACIA SAMASSAE* PESTA, A RARE CALANOID COPEPOD
FROM THE ARABIAN SEA*

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INTRODUCTION

PESTA (1941) described a new species, *Candacia samassae* from the Red Sea based on two females collected during the 'POLA' Expedition, 1896. In a revision of the family Candaciidae, Grice (1963) recognises *C. samassae* as a valid species based on its original description. Recently, Jones (1966) recorded both sexes of this species from the Arabian Sea and the Bay of Bengal but without any description. In the course of examining the plankton samples obtained during the cruises of R.V. *VARUNA* off the west coast of India from 1962-66, the author came across specimens of both sexes. 16 species of the genus *Candacia* have to-date been reported from the Indian Ocean and the males of all but *C. samassae* are known. The occurrence of both females and males in a few samples, the specific characters common to both, namely; the presence of a mid-dorsal hump on cephalosome and the nature of mandibles and cephalic appendages have helped in the identification of the males. As the male has remained undescribed, and Pesta's original description of the female is incomplete in diagnostic details, a detailed description of both sexes is given here.

Candacia samassae Pesta
(Figs. 1 & 2)

MATERIAL: 31 females and 11 males collected from 14 stations (Table 1) off the west coast of India from 1962-66.

TABLE I
List of R.V. *VARUNA* Stations from where *C. samassae* were collected

| Stn. No. | Position | | Time (hrs.) | Depth at Stn. (m.) | Depth of haul (m.) | No. of Specimens |
|----------|----------|---------|-------------|--------------------|--------------------|------------------|
| | Lat. N | Long. E | | | | |
| 1032 | 07°18' | 76°41' | 11.00-13.15 | 1700 | 200-0 | F-1; M-4 |
| 1034 | 07°31' | 76°57' | 16.48-17.20 | 106 | 100-0 | F-1; M-2 |
| 1059 | 09°25' | 75°23' | 09.00-10.10 | 1200 | 200-0 | F-1; M-1 |
| 1071 | 09°41' | 75°07' | 23.45-02.00 | 2300 | 200-0 | F-4 |
| 1072 | 10°11' | 75°11' | 05.30-06.50 | 1550 | 200-0 | M-1 |
| 1174 | 15°06' | 72°58' | 04.45-05.25 | 730 | 200-0 | M-1 |
| 1806 | 18°30' | 70°00' | 02.45- | 1250 | 200-0 | F-2 |
| 2023 | 09°45' | 75°26' | 20.40-23.05 | 1600 | 1200-0 | F-2 |
| 2168 | 08°10' | 75°20' | 15.45-17.00 | 1800 | 1000-0 | F-4 |
| 3311 | 12°50' | 73°30' | 19.00-20.00 | 1000 | 800-0 | F-5 |
| 3313 | 12°50' | 74°06' | 01.05-02.00 | 200 | 175-0 | F-9 |
| 3319 | 11°45' | 74°03' | 18.00-19.05 | 1600 | 600-0 | M-2 |
| 3345 | 11°45' | 74°25' | 04.25-05.40 | 1400 | 800-0 | F-1 |
| 3463 | 07°45' | 76°28' | 21.10- | 1110 | 200-0 | F-1 |

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LENGTH AND BODY PROPORTIONS :

| | Total length in mm. | | | Prosome-Urosome length ratio |
|------------------|---------------------|------|-----------|------------------------------|
| | No. | Mean | Range | |
| Adult Females .. | 31 | 1.67 | 1.28-1.74 | 40 : 11.8 |
| Adult Males .. | 11 | 1.60 | 1.54-1.66 | 73 : 27.5 |

The specimens are deposited in the Reference Collection Museum of the Central Marine Fisheries Research Institute, Mandapam Camp, S. India.

Female : (Figs. 1 a-p & 2 h). Cephalon and first metasome segment partly fused ; a well developed backwardly directed mid-dorsal hump present on the cephalon posteriorly ; prosome widest at the first segment of metasome ; cephalon anteriorly truncate and narrow ; rostrum short, chitinised and slightly elevated ; metasome segments 2 and 3 are of same length, 4 and 5 fused ; posterior corners of last metasome segment symmetrically produced backwards into acutely pointed conical lobes ; second, third and last metasome segments with short hairs on lateral tergites ; urosome with three segments, and with caudal rami showing the following proportionate lengths :

| Segments | 1-3 | 4 | 5 | rami |
|----------|-----|----|----|--------|
| % | 47 | 21 | 15 | 17=100 |

Genital segment (Fig. 1b & c) with swollen and convex sides, appearing symmetrical dorsally but midventrally two subequal well developed lobes present one behind the other ; the post genital segment slightly larger than the anal ; caudal rami almost as broad as long with slender and straight appendicular setae ; interspace between the two outer marginal setae markedly great ; a small 'tooth' present dorsally above origin of midcaudal seta on each ramus.

Antennule (Fig. 1e) with 24 segments, long, slender and reaching middle of the second urosome segment ; segments of antennule with the following proportions :

| Segments | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|
| % | 6.1 | 4.5 | 2.0 | 1.6 | 2.9 | 3.7 | 2.8 | 1.6 | 2.8 | 2.0 | 2.4 | | |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | |
| | 4.1 | 4.5 | 4.9 | 5.3 | 5.7 | 6.1 | 6.5 | 6.9 | 6.5 | 4.1 | 3.2 | 4.5 | 5.3=100 |

proximal seven segments thickened ; segments 2 to 10 each provided with a short anterior marginal spine ; lateral frontal edge of first segment with three setae ; second segment elevated at distal anterior margin ; third segment with anterior margin bearing setae and spines, greatly narrowed ; seta on 23rd segment very long ; segments 8 to 21 each with an aesthetask along outer lateral margin.

Antenna (Fig. 1f) as in the genus ; exopod with six apical and a thin subterminal seta ; second endopodal segment bilobed, external lobe with five terminal setae and internal lobe with seven setae, one very thin.



FIG. 1. *Candacia samasse* Pesta Female. a: dorsal view; b: lateral view; c: last metasomal segment and urosome; d: right caudal ramus, enlarged; e: antennule; f: antenna; g: mandible; h: mandibular blade, enlarged; i: maxillule; j: maxilla; k: maxilliped; l: first swimming leg; m: second swimming leg; n: third swimming leg; o: fourth swimming leg; p: fifth pair of legs.

Mandible (Fig. 1g, h) well developed with a large basal segment; exopod with five setae, innermost being subterminal; endopod with six setae; each mandibular blade with a sharp tooth and a basal process tricuspidate apically, middle cusp being largest.

Maxillule (Fig. 1i) Gnathobase of proboscis with nine setae and one curved thick spine.

Maxilla (Fig. 1j) large, first basipodal segment with four sets each of two subequal spines and setae; second basipodal segment with two large spines on the inner lateral margin, distal one of which is longer than proximal one; endopod provided distally with three very large spines, middle one longest and proximal shortest; three small subequal bristles present at base of distal spine.

Maxilliped (Fig. 1k) reduced in size; first basal segment longer than combined length of remaining segments; inner margin with a tubercle near proximal end, a single long seta in dorsal half and two slender subequal setae at distal upper corner; inner margin of second basipodal segment with a patch of hair and three setae of about equal length; third segment with three setae; segment four to six each with a pair of setae; sixth segment at the apex carry two long setae of more or less equal length; all setae are beset with fine marginal hairs.

Swimming legs (Fig. 1l—o). Exopodite three-segmented and endopodite two-segmented; distal outer margin of the third exopod segment of leg-1 concave; terminal spine of third exopod segment of leg-3 prominently curved outwards; setal and spine formulae of the four swimming legs are shown in Table 2.

TABLE 2

| | Exopodite | Endopodite |
|--------|-------------------|------------|
| Leg -1 | 1+I. 1+I. 4+I+II | 3+0. 3+2+1 |
| Leg -2 | 1+I. 1+I. 5+I+III | 3+0. 4+2+2 |
| Leg -3 | 1+I. 1+I. 5+I+III | 3+0. 4+2+2 |
| Leg -4 | 1+I. 1+I. 5+I+III | 3+0. 3+2+2 |

(spines in Roman and setae in Arabic numerals)

Fifth pair of legs (Figs. 1p & 2-h) symmetrical, long and slender, each ending in three subequal spines (trifid) with crenulated margins; median spine longest; terminal segment at about its mid-length with a slender spine on the outer margin; second segment with a short seta on its upper surface.

Male: (Figs. 2 a-g). Slightly smaller than the female; general shape of body resembles that of females; cephalon and first metasome segment partly separated; metasome anteriorly truncate and narrow; rostrum chitinized and more pronounced than in the female; mid-dorsal hump present on the cephalon, directed posteriorly; hump lacking in pronounced pigmentation; fourth and fifth metasome segments indistinctly separated; posterior lateral angles of the fifth metasome segment produced into sharp wing-like processes. Urosome and caudal rami have the following proportions:

| Segments | 1 | 2 | 3 | 4 | 5 | rami |
|----------|----|----|----|----|---|----------|
| % | 24 | 25 | 18 | 11 | 7 | 15 = 100 |

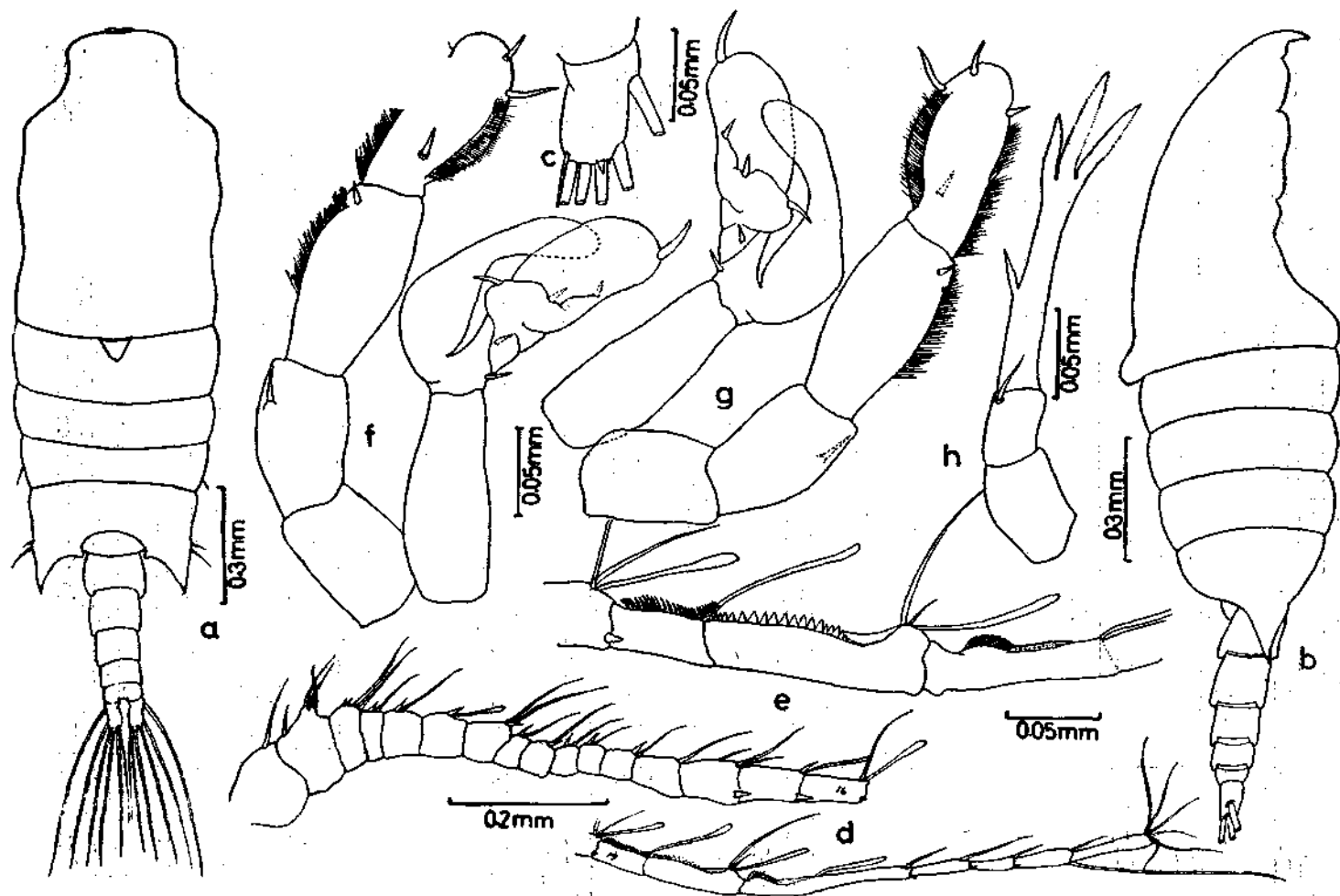


FIG. 2. *Candacia samassæ* Pesta. Male. a. dorsal view; b. lateral view; c. right caudal ramus; d. geniculate antennule; e. 17 to 19 segments of geniculate antennule; f. fifth-pair of legs, dorsal view; g. fifth pair of legs, ventral view; Female. h. left fifth leg, enlarged.

Genital segment with a perceptible protuberance on the right side ; anal segment with a rudimentary anal lamina ; caudal rami distinctly longer than broad ; prominent interspace present between outermost caudal seta (directed postero-laterad) and inner four setae (directed posterad) ; appendicular setae straight.

Antennule (Fig. 2 *d* & *e*) long, slender and surpasses caudal rami by last two segments. Left antennule with 24 segments. Right antennule geniculate, with 23 segments, showing the following proportions :

| Segments | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|
| % | 6.1 | 4.3 | 2.2 | 1.7 | 3.0 | 3.5 | 3.0 | 2.2 | 2.6 | 2.2 | 2.6 | 3.0 |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |
| | 4.3 | 4.8 | 5.2 | 5.6 | 4.3 | 6.5 | 14.3 | 4.3 | 3.9 | 4.3 | 6.1 | =100 |

First seven segments same as in female ; segments 14, 15 and 16 each with a small spine-like process on the distal margin ; segments 17, 18 and 19 with a row of teeth along outer lateral margin ; teeth on segment 18 coarse, coloured brown by pigments ; those on segments 17 and 19 fine ; teeth on segment 17 and 18 extend over most of their length while on segment 19 a row of long villiform teeth extends to hardly two-thirds its length ; 23rd segment with long seta on distal inner margin as in female ; aesthetetes were observed, one each on segment 6 and on segments 16 to 20.

Fifth pair of legs (Fig. 2 *f* & *g*) asymmetrical ; the right fifth leg two-segmented, chelate and shorter than left leg ; finger of chela with a large solitary spine placed distally ; one long and one short spine present on the raised inner margin ; two surface spines present anterad and posterad to the elevation ; finger with a short outer marginal spine at the base ; thumb of chela short and naked ; left fifth leg with four segments, terminal exopodal segment with four marginal spines and a single surface spine ; both outer and inner margins of fourth segment haired ; penultimate segment with a short spine at the distal outer end, and beset with hairs on its outer margin limited to distal two-thirds of the segment ; a short seta present on the second basipodal segment.

REMARKS

Candacia samassae is morphologically allied to, but distinctly different from the nearest related '*longimana-curta-varicans*' group. The diagnostic characters are : (1) the tricuspidate gnathal lobe of mandible with middle cusp longest and second basipodal segment of maxilla with two long spines, distal, one being longest in both the sexes ; (2) the ventrally bilobed genital segment of the female and (3) the details of sexually modified characters such as the geniculate antennule with the distal spine-like process on segments 14, 15 and 16 ; segment 18 with coarse pigmented teeth, segments 17 and 19 with long and villiform teeth ; and the ornamentation of the fifth legs of the male.

Pesta (1941) based his description on two female specimens of which one is an immature as could be seen from his illustrations (p. 166, fig. 4, referring to specimen from stn. 157). Adults in the present collection show very little difference

from the original description. The presence of the marginal seta on the second basipodal segment of the female fifth legs in the present specimens are shown as absent in the specimens described by Pesta (1.c). Further, the maxilla figured by him does not show the two setae on the first basipodal segment whereas these were present in my specimens.

Pesta's specimens were taken from Northern Red Sea in the vertical hauls from 500 and 1000 m. Jones (1966) collected this species from the hauls between 125 and 250 m. in the Arabian Sea and oblique hauls from 200 m. in the Bay of Bengal, but none were present in the night surface hauls. Present specimens were encountered only in the vertical hauls from 100 and 1200 m. (Table 1) made by Indian Ocean Standard net during day and night. Though this does not permit a conclusion regarding the actual depth of occurrence of this species, it may be considered that *C. samassae* inhabits deeper waters.

SUMMARY

Candacia samassae, an uncommon calanoid copepod collected off the west coast of India is redescribed to add a few more details to the original description. The male of this species which is hitherto unknown is described. It is considered that *C. samassae* is an inhabitant of deeper waters.

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