8. APPENDICES I - III: PUBLISHED PAPERS.
A NEW SPECIES OF MACANDREWELLA  
(COPEPODA: CALANOIDA) FROM OFF COCHIN,  
SOUTH WEST COAST OF INDIA  

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ABSTRACT  

Macandrewella cochinensis is described and compared with other species of the genus. Examination of the specimens revealed that they cannot be assigned to any of the known species of the genus though they had similarities with M. joanne and M. scotti.  

INTRODUCTION  

During the course of the studies on the copepod family Scolecithricidae from the International Indian Ocean Expedition collections, some specimens of both sexes belonging to the genus Macandrewella were observed in a sample taken by "R. V. Conch" from a station at Lat. 10°10'N, Long. 75°46'E (IOBC Hand book Vol.1, 1969). They were different from the seven known species of the genus and hence described as new. Specimens belonging to the same species were later collected from a sample taken by "Blue Fin" at Lat. 09° 48'N, Long. 75°39' E (N. I. O., 1969-70).  

DESCRIPTION OF SPECIES  

Macandrewella cochinensis n. sp.  

Female (Fig. la): Head and the first thoracic segment fused together with a faint line of demarcation laterally. Forehead with a lens-like organ at the base of the rostrum. Fourth and fifth thoracic segments completely separated. Postero-lateral corners of the last thoracic segment asymmetrical, each side drawn out into a stout curved spine with a distinct tooth at the base. Spine on the left side longer than the spine on the right side reaching the level of the distal margin of the first urosome segment (Fig. lb). Rostrum with a bifurcate base and one filament attached to each ramus.  

Abdomen four segmented, genital segment symmetrical in outline in dorsal view and with a ventral backwardly directed protuberance (Fig. lc). Posterior margin of the second and the third abdominal segments fringed with fine spines. Fourth abdominal segment shortest. Caudal furca almost as long as wide. Five caudal setae attached to each furcal joint. Middle caudal seta on the left side elongated.  

Antennules with 23 separate segments. Antennae, mandibles, maxillae and maxillipeds in general structure almost similar to those of the other species of the genus with the following differences. Chewing blade of each mandible carries 8 teeth; inner tooth long, curved and serrated (Fig. lc). First basal of the maxilliped with a short row of fine curved spines at its proximal end on either side. Second basal just behind the anterior margin, on either surface carries a long row of fine spines, along its entire length. Spines at the centre of this row are short and those at the ends are long (Fig.2f).  

Segmentation of legs 1-4 (Figs. 3a,b,c,d) as in M. Scotti Sewell, with the following differences. Outer border of exopod 3 of leg 1 even and straight, external spines on the three exopod segments almost subequal. First basal segment of leg 2 with a small spine behind the distal external angle. Exopod segment 2 of leg 2 and 3 with a transverse, crescent-shaped row of spines towards the distal border, segment 3 provided with a group of small spines on the surface towards the middle. Endopod 1 of leg 2 drawn out into a spine at the distal external angle. Endopod 2 of leg 2 with two rows of three spines each. Spines in the outer row almost equal. Spines in the inner row unequal. Endopod segments 1 and 2 of legs 3 and 4 drawn out into spines at their distal external angle, segments 2 and 3 with stout sharp spines on the surface. Spines on the sur-
A NEW SPECIES OF MACANDREWELLA

Fig. 1. Macandrewella cochinensis, n. sp. Female.
(a) Dorsal view, (b) Lateral view of posterior part from left side, (c) Lateral view of posterior part from right side.

Face of segments 2 and 3 of both exopod and endopod of leg 4 arranged in vertical rows. Leg 5 absent.

Material examined: Total 25 specimens from the two samples.
Length range: 3.0 - 3.15 mm.

Male (Fig. 4a): Head and first thoracic segment fused together, forehead carries lens-like organ. Posterolateral corners of the last thoracic segment symmetrical, each side with stout curved spines. Abdomen five segmented. Posterior margin of second, third and fourth abdominal segments fringed with fine spines. Four caudal setae on each caudal rami. Antennules with 20 segments on the right side and 21 on the left side. Mouthparts as in female. Legs 1-4 as in female but with reduced armature. Leg 5, in general structure resembles that of the other species in the genus. Right leg with the first basal with an angular expansion towards the proximal one-third; the second basal segment dilated, proximal part of endopod with a curved and blunt distally directed process, a median conical protuberance and a curved tapering distal end; first exopod segment bearing an irregular wing-like expansion at the proximal part, a small rounded prominence in the middle and an evenly curved prominent process towards the distal end, second segment with an internally directed club-shaped process almost as long as the entire segment, third segment bent on itself at about the middle with a thin transparent web-like structure connecting the two halves. In left leg second basal longer than first, endopod one-segmented and almost straight, with two triangular expansions and a row of strong teeth distally; exopod two-segmented, tip of second segment with a thin plate-like structure covered with a dense tuft of long cilia and with a thin pointed claw (Fig. 4b).

Material examined: Total 31 specimens from the two samples.
Length range: 2.9 - 2.95 mm.
Fig. 2. *Macandrewella cochinensis* n. sp. female.
(a) Antennule, (Magnification double that of the other appendages), (b) Antenna, (c) Mandible,
(d) 1st maxilla, (e) 2nd maxilla, (f) Maxilliped.
Fig. 3. Macandrewella cochinensis, n. sp. female.
(a) — (d) legs 1 — 4.
Fig. 4. *Macandrewella cochinensis* n. sp. male.
(a) Dorsal view (b) Leg 5.
<table>
<thead>
<tr>
<th></th>
<th><em>M. joaneae</em></th>
<th><em>M. scotti</em></th>
<th><em>M. chelipes</em></th>
<th><em>M. Sewelli</em></th>
<th><em>M. asymmetrica</em></th>
<th><em>M. mera</em></th>
<th><em>M. agassizi</em></th>
<th><em>M. cochinensis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Length (mm)</td>
<td>3.6</td>
<td>3.2</td>
<td>3.5</td>
<td>3.5 - 3.7</td>
<td>3.5 - 3.7</td>
<td>3.84</td>
<td>3.0</td>
<td>3 - 3.15</td>
</tr>
<tr>
<td>Posterolateral corners of the last thoracic segment</td>
<td>Asymmetrical with the spine on the left side extending beyond the middle of the genital segment</td>
<td>Symmetrical</td>
<td>Symmetrical</td>
<td>Symmetrical</td>
<td>Asymmetrical with the spine on the left side bent outwards at an angle of about 45°.</td>
<td>End laterally in short sharp points directed slightly inwards. Dorsal to the point on the right side the margin of the segment is produced into a short tooth which bears a few spinules on its margin.</td>
<td>Symmetrical with the spine on the left side reaching the level of the distal margin of the first uroscope segment.</td>
<td></td>
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<tr>
<td>Genital segment</td>
<td>Asymmetrical in dorsal view. Ventral surface produced posteriorly into a small blunt lobe.</td>
<td>Symmetrical in dorsal view.</td>
<td>Symmetrical in dorsal view.</td>
<td>Asymmetrical with a lobe at the right posterior corner overlapping the next abdominal segment.</td>
<td>Asymmetrical with a swollen lateral projection on the right side, slightly overlapping the following segment dorsally and with a ventral backwardly directed thumb-like process projecting from the genital boss.</td>
<td>Asymmetrical with a swelling strongly elevated on the right side, ventrally a thumb-like projection with a stout directed back-spine at the posterior end.</td>
<td>Asymmetrical in dorsal view, strongly elevated along mid posteriorly directed protuberance on ventral side.</td>
<td></td>
</tr>
<tr>
<td>Spines on the posterior margin of abdominal segments</td>
<td>Present on 1st, 2nd and 3rd segments.</td>
<td>Present on 2nd and 3rd segments.</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Present on 2nd and 3rd segments.</td>
</tr>
<tr>
<td>Caudal furca</td>
<td>As long as broad</td>
<td>Short and broad</td>
<td>Wider than long</td>
<td>Wider than long</td>
<td>As broad as long</td>
<td>—</td>
<td>Wider than long</td>
<td>As long as broad</td>
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<tr>
<td></td>
<td><em>M. joanae</em></td>
<td><em>M. scotti</em></td>
<td><em>M. chelipes</em></td>
<td><em>M. sewelli</em></td>
<td><em>M. asymmetrica</em></td>
<td><em>M. mera</em></td>
<td><em>M. agassizi</em></td>
<td><em>M. cohnensis</em></td>
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<tr>
<td>Caudal setae</td>
<td>5 on each side, asymmetrical with middle setae on left side elongated.</td>
<td>5 on each side, symmetrical.</td>
<td>4 on each side, symmetrical.</td>
<td>4 on each side, symmetrical.</td>
<td>Symmetrical with 2nd inner setae on left side elongated.</td>
<td>4 on each side, symmetrical with middle setae on left side elongated.</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Leg 5</td>
<td>Present</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Present</td>
<td>Absent</td>
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<tr>
<td>Male</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Length (mm)</td>
<td>3.4</td>
<td></td>
<td>Smaller than female</td>
<td>3.25</td>
<td>3.7</td>
<td>Male not recorded.</td>
<td>2.95</td>
<td>2.9 - 2.95</td>
</tr>
<tr>
<td>Spines on the posterior margin of abdominal segments</td>
<td>Present on 2nd, 3rd and 4th abdominal segments.</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td></td>
<td>Absent</td>
<td>Present on 2nd, 3rd and 4th abdominal segments.</td>
<td></td>
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<tr>
<td>5th leg Right</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Similar to that figured by Scott for <em>M. joanae</em> and differ only in small details which can be best seen by comparison of the figures.</td>
<td>Absent</td>
<td>3 segmented</td>
<td>3 segmented,</td>
</tr>
<tr>
<td>Exopod</td>
<td>2 segmented</td>
<td>3 segmented</td>
<td>3 segmented</td>
<td>3 segmented</td>
<td></td>
<td></td>
<td>A knob at the inner distal corner.</td>
<td></td>
</tr>
<tr>
<td>Exopod 1</td>
<td>Produced internally into a strong curved claw which exceeds the length of the joint, middle inner margin produced into stout tooth.</td>
<td>Fused with second basal, a wing-like projection at proximal end, about the junction of the middle and distal thirds a small rounded lobe, a club-shaped prominence at the distal end.</td>
<td>An angular swelling on the outer margin at the centre, a small knob at the inner distal corner.</td>
<td>Extends beyond the articulation with the second segment as a curved finger-like process.</td>
<td></td>
<td></td>
<td>An irregular wing like expansion at the proximal part, small rounded prominence in the middle and an evenly curved prominent process at the distal end.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>\textit{M. joanae}</td>
<td>\textit{M. scotti}</td>
<td>\textit{M. chelipes}</td>
<td>\textit{M. sewelli}</td>
<td>\textit{M. asymmetrica}</td>
<td>\textit{M. mera}</td>
<td>\textit{M. agassizi}</td>
<td>\textit{M. cochinisensis}</td>
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<tr>
<td>\textbf{Exopod 2}</td>
<td>Forked at the apex</td>
<td>A strong inwardly directed blunt process at the base equal in length to the whole segment.</td>
<td>A curved process at the base and a small straight process near the centre of the inner margin.</td>
<td>Outer side articulated with the inner side of 1st segment, proximal end enlarged into a trilobed knob which extends behind the articulation.</td>
<td>\text{---}</td>
<td>\text{---}</td>
<td>A sickle shaped process on the inner margin at the base, projects distally beyond the joint with the third segment.</td>
<td>An internally directed club-shaped process almost as long as the entire segment.</td>
</tr>
<tr>
<td>\textbf{Exopod 3}</td>
<td>\text{---}</td>
<td>Sickle shaped.</td>
<td>Sickle shaped; a knob on the convex margin, point of sickle overlaps the base of the second segment.</td>
<td>Bent at right angles near its centre with a long process, toothed at the tip on the outer angle of the bent.</td>
<td>\text{---}</td>
<td>\text{---}</td>
<td>Bent at right angles near its centre and the terminal claw-like part overlaps the sickle-like process at the base of the 2nd segment.</td>
<td>Bent on itself at the middle with a thin transparent web-like structure connecting the two halves.</td>
</tr>
<tr>
<td>\textbf{Endopod}</td>
<td>One jointed long curved.</td>
<td>One jointed long curved.</td>
<td>Slender, reaches the distal end of exopod 2.</td>
<td>Extends beyond exopod 2, curved and blunt at the tip, a sharp process on the inner margin near the base and another towards the tip.</td>
<td>\text{---}</td>
<td>\text{---}</td>
<td>One jointed, a single knob near the centre of the outer margin.</td>
<td>One jointed, proximal part with a curved and blunt distally directed process, a median conical projection and a curved tapering distal end.</td>
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<tr>
<td>\textbf{Left leg}</td>
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<tr>
<td>\textbf{Exopod}</td>
<td>2 jointed.</td>
<td>2 jointed</td>
<td>3 jointed</td>
<td>2 jointed</td>
<td>\text{---}</td>
<td>\text{---}</td>
<td>3 jointed</td>
<td>2 jointed.</td>
</tr>
<tr>
<td>\textbf{Exopod C2}</td>
<td>Short, dilated, apex furnished with a pad of claw-like processes with a tuft of hairs and a spine.</td>
<td>Terminates in a claw-like process with a tuft of hairs.</td>
<td>Equal in length to exopod 1.</td>
<td>Enlarged at its distal end with an outer serose process.</td>
<td>\text{---}</td>
<td>\text{---}</td>
<td>Somewhat widened.</td>
<td>A thin plate-like structure at the tip covered with dense tuft of long cilia and with a thin pointed claw.</td>
</tr>
<tr>
<td></td>
<td>M. joanae</td>
<td>M. scotti</td>
<td>M. chelles</td>
<td>M. sewelli</td>
<td>M. asymmetrica</td>
<td>M. mera</td>
<td>M. agassizi</td>
<td>M. cochinensis</td>
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<tr>
<td><strong>Exopod 3</strong></td>
<td>—</td>
<td>—</td>
<td>Short and claw shaped</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</table>

**Endopod**

- One jointed, sickle-shaped, as long as exopod, distal half of inner margin serrated.
- One jointed, curved and with a row of serrations at the distal end. Shorter than exopod.
- One jointed, nearly as long as exopod, dentate on its inner margin.
- One jointed, shorter than exopod, laminate and truncate at its tip, with a sharp spine at the centre and a row of coarse teeth distal to the spine.
- One jointed, nearly as long as exopod, two angular processes on the outer margin, three minute teeth at the tip.
- One jointed, shorter than exopod, almost straight, two triangular expansions, a row of strong teeth distally.

With a rounded process and a soft pointed filament on its inner surface, rounded tip covered with hairs.
Types: Holotype 1 female, allotype 1 male and paratypes 2 females and 2 males are deposited in the reference collection at the Regional Centre of N. I. O. (CSIR), Cochin-18, India, Reg. Nos: I. O. B. C. 0146, 0147, 0148 respectively. In the table the distinctive features of the species in the genus Macandrewella are summarised.

DISCUSSION

Scott (1909) created the genus Macandrewella to accommodate the new species *M. joanae* collected by “Siboga” in the Malay Archipelago. Scott also included in the genus the copepod that Giesbrecht (1896) had described from the Red Sea under the name *Scoleocithrix chelipes*. There are seven established species of the genus; *M. joanae*, *M. chelipes* (Giesbrecht 1896), *M. scotti* Sewell (1929), *M. sewelli*, *M. asymmetrica*, *M. mera* Farrán (1936) and *M. agassizi* Wilson (1950). Female of *M. cochinensis* resembles *M. joanae* in the extreme asymmetry of the posterolateral corners of the last thoracic segment with the spine on the left side reaching the level of the distal margin of the first urosome segment and in the asymmetrical caudal setae with the middle seta on the left side elongated. But the absence of leg 5 is an important character distinguishing it from the latter species. Leg 5 of male in *M. cochinensis* is distinct, in the structure of the different parts, from the other species, though retaining the basic form in the genus. Sewell (1929) while describing females of *M. scotti* refers in the text to the similarity with *M. joanae* in the shape of the posterolateral corners of the thorax, but from figures it has to be assumed that though there are spiny projections they are not comparable to the distinctly asymmetrical spines of *M. Joanae*. Moreover, Sewell makes special mention of the symmetrical caudal setae. They are asymmetrical in *M. cochinensis* as well as in *M. Joanae*. Apart from the variations in the distribution of spines on the maxilliped and legs 1–4, the straight outer border of exopod 3 of leg 1, instead of a notched border in *M. scotti* is a well marked feature of *M. cochinensis*. Thus *M. cochinensis* though possessing certain characters in common with *M. joanae* and *M. scotti* is quite distinct from them and also from the other species in the genus.

ACKNOWLEDGEMENTS

I am grateful to Dr. N. K. Panikkar, Director, National Institute of Oceanography, India and Dr. T. S. S. Rao, Officer-in-Charge, Regional Centre of N. I. O, for their interest in the progress of this study and for their encouragements. My sincere thanks to Dr. Janet M. Bradford for giving an authoritative opinion regarding the identification and to Dr. W. Vervoort, Rijksmuseum Van Natuurlijke Historie for critical reading of the manuscript and for his valuable suggestions.

REFERENCES

FARRAN, G. P., 1936

GIESBRECHT, W., 1896

PANIKKAR, N. K. (Ed.), 1969
Handbook to the International zooplankton Collections, IOBC, I. Station List.

N. I. O., 1969-70
National Institute of Oceanography, India, Annual Report 5: 2-8; 33-36.

SCOTT, A., 1909

SEWELL, R. B. S., 1929

WILSON, C. B. 1950
A REVIEW OF THE COPEPOD SCOTTOCALANUS SECURIFRONS (T. SCOTT) AND A NOTE ON ITS SYNONYM SCOLECITHRIX CUNEIFRONS WILLEY (CALANOIDEA: SCOLECITHRICIDAE)

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Regional Centre of National Institute of Oceanography (C. S. I. R.) Cochin, India

ABSTRACT
Scottocalanus securifrons from the International Indian Ocean Expedition Collections is described and compared with that of T. Scott 1893, A. Scott 1909, Tanaka 1961, Lophothrix securifrons Wolfenden 1904 and Scolecithrix cuneifrons Willey 1918. A thorough examination of the descriptions of securifrons and cuneifrons and the examination of 2 syntypes of S. securifrons from the British Museum revealed a doubtful existence of Scolecithrix cuneifrons as a distinct species. Hence it is considered as a synonym of S. securifrons in agreement with Vervoort (1965).

INTRODUCTION
While studying the scolecithricid copepods collected during the International Indian Ocean Expedition 1960-65 (IIOE) I encountered a number of specimens of both sexes belonging to the genus Scottocalanus Sars. Upon comparing the IIOE specimens with published descriptions of species of Scottocalanus, I found good agreement with S. securifrons (T. Scott, 1893) and also with S. cuneifrons (Willey, 1918). The IIOE specimens are assigned to the older S. securifrons and described below.
Scottocalanus securifrons (T. Scott)
(Figure 1 a–g, Figure 2 a–c, Figure 3 a–h)

Scottocalanus securifrons T. Scott, 1893, p. 47, pl. 4, figs. 40–56, pl. 5, fig. 1 [♀ only, ♂ = Scolecithrix helenae (Lubbock)].—Ciesbrecht and Schnell, 1898, p. 49.—van Bremen, 1908, p. 76, fig. 88 [♀ only].—Cann, 1896, p. 425.—Thompson, 1903, p. 20.—Norman 1903, p. 137.—Cleve, 1904, p. 197.—Cons. Explor. Mer, 1909, p. 99.—Jespersen, 1940, p. 36.

Lophothrix securifrons Wolfenden, 1904, p. 120, pl. 9, figs. 12–15.

Lophothrix securifrons (T. Scott).—Wolfenden, 1911, p. 298.

Scottocalanus acutus Sars, 1905, p. 7.

Scolecithrix cuneiformis Willey, 1918, p. 194, figs. 17–24.


Description of the specimens: Female. Length 4.2 mm. Head and first thoracic segment, 4th and 5th thoracic segments fused. Head with high median crest (Fig. 1c). Last thoracic segment produced posteriorly into triangular expansion terminating in sharp pointed spine on either side. Rostrum bifid at tip (Fig. 2 a). Abdomen 4-segmented. Genital segment swollen ventrally at mid-length; its ventral posterior margin overlapping the following segment (Fig. 1 d). Posterior lateral margins of genital segment furnished with spines which are absent on dorsal and ventral side (Fig. 1 e). A. Scott (1909) shows spines on the posterior margin of the genital segment present on the dorsal as well as lateral surfaces. Posterior margins of 2nd and 3rd abdominal segments with a hyaline fringe (Fig. 1 e). Anal segment very short. Caudal rami almost as wide as long, each with 4 setae.

First antenna with 23 separate segments, when the partly separated 8th and 9th segments are counted as one (Fig. 1 a). First maxilla with
numbers of setae on different lobes as follows (Fig. 2 b): Inner lobe 1 with 12 setae of which 3 are on posterior surface; inner lobe 2 with 2 setae; inner lobe 3 with 3 setae; basipod 2 with 5 setae; endopod segment 1 with 3 setae; endopod segments 2 and 3 together with 4 setae; exopod with 8 setae; outer lobe with 9 setae. Exopod segment with fine surface hairs at distal end. Second maxilla endopod with 4 bud-like and
3 vermiform filaments (Fig. 2 c). Swimming legs 1–4 as shown in figures (Figs. 3 a–d).

Fifth pair of legs asymmetrical; subapical spine of left leg thicker than that of right leg. Subapical spines with two rows of teeth (Fig. 3 e).

Male. Length 4.57 mm. General appearance similar to that of female. Head with high median crest (Fig. 1 f). Last thoracic segment terminating in small spine on either side (Fig. 1 g). Abdomen 5—segmented. Posterior margin of 2nd to 4th abdominal segments with hyaline fringe (Fig. 1 g). First antenna with 20 segments when fused 8th to 12th segments, partly divided by 2 incomplete sutures between segments 8 and 9 and 11 and 12, are counted as one (Fig. 1 b). 5th leg as illustrated (Fig. 3 f–h). The small teeth on the inner margin of the proximal joint of the endopod of the left leg figured by A. Scott are not present in Tanaka’s specimens, Willey’s specimens or in the IIOE specimens.

**DISCUSSION**

The IIOE specimens agree well with descriptions of *S. securifrons* by T. Scott (1893, ♀ only), A. Scott (1909), Wolfenden (1904), and Tanaka (1961). They also appear to conform to Willey’s (1918) description of *S. cuneifrons*. Willey was aware of the similarity of his *S. cuneifrons* to *S. securifrons*, and stated that he was at first inclined to identify his specimens as *S. securifrons*, but decided to establish a
new species for them because the male fifth legs of his specimens differed from those of *S. securifrons*. Apparently he was referring to T. Scott's male, which is now believed to belong to a different species, *Scotocalanus helenae* (Lubbock), and not to the male described by A. Scott which had a fifth leg very similar to that of *S. cuneifrons*. Curiously,
Willey did not cite either T. Scott (1893) or A. Scott (1909) in his bibliography.

In order to be certain about the identity of T. Scott's specimens, I requested a loan of them from The British Museum (Natural History). Although Scott (1893) reported S. securifrons from 5 "Buccaneer" stations, Dr. Roger J. Lincoln reported that the British Museum had only 2 females, the male being missing. Upon examining these 2 females, I found that one of them is not S. securifrons but another species of Scottocalanus, possibly S. australis Farran (1936). The remaining female is herewith designated as the lectotype of Scolicithrix securifrons T. Scott in order to obviate further confusion.

**Distribution:** The species has a fairly wide distribution, and has been recorded from the Atlantic, Pacific and Indian Oceans. It has been recorded from the central and southern part of the Arabian Sea (Sewell, 1947), from the Indian Ocean off Port Shepstone, South Africa (Cleve, 1904a), from many localities in the eastern part of the Malay Archipelago (A. Scott, 1909, and Smellius Expedition), from the Philippine Islands region (Wilson, 1930), from the central equatorial Pacific, 00°03'N, 157°00'E (Grice, 1962), from the California Current region (Fleminger, 1967), from Sagami and Suruga Bays, Izu region, Japan (Tanaka, 1937, 1938) from surface waters off Three Kings Islands, New Zealand (Farran, 1929), from many localities in the West-Pacific ranging from off Peru to the Galapagos Islands region (Wilson, 1950) and from the Far Eastern and Polar Seas of the U.S.S.R. (Brodsky, 1950). The specimens described in this paper are from around the central part of the equatorial Indian Ocean (03°29'N, 77°54'E).

In the Atlantic S. securifrons is widely distributed over large areas, penetrating at least as far north at the Atlantic slope off Cabot Strait, 42°31'N, 63°31.5'W (Willey, 1918) and 43°18'N, 60°11'W (Rose, 1929). Also known from 47°47'—63°08'N, 8°00'—20°20'W (With, 1915; Lysholm and Nordgaard, 1921); the South coast of Iceland, 63°08'N, 21°30'W; 62°47'N, 15°03'W (Paulsen, 1909; Jespersen, 1940); the Faroe Channel, ± 60°N, 7°W (Norman, 1903; Wolfenden, 1904); 28°—58°N, 7°—50°5'W (Lysholm, Nordgaard and Wiborg, 1945); NNW of Achill Head, Ireland (Norman, 1903); 52°06'—54°33'N, 10°30'—15°53.9'W (Thompson, 1903; Farran, 1908); off the south-west coast of Ireland (Farran, 1920); 27°43'—47°43'N, 8°06'—42°40.5'W (Sars, 1925); Bermuda (Wilson, 1936); 30°08'N, 31°19'W (Sars, 1912); Florida current (Owre, 1962); between Bermuda and New York (Grice and Hart, 1962); Bay of Biscay ± 47°N, 8°W (Farran, 1926); 44°17'N, 4°38'W (Canu, 1896); 20°41'N, 31°53'W; 17°28'N, 29°42'W, 16°24'N, 28°53'W (Wolfenden, 111); Gulf of Guinea (T. Scott, 1894); off Angola (Marques, 1956, 1958, 1959); 26°59'S, 17°06'W and 35°10'S, 2°33'W (Wolfenden, 111). It has been captured in the northern part of the North Sea during the periodical plankton investigations, 1902—1908 (Cons. Explor. Mer 1909, Scottish area). It has been recorded from the southeastern United States between Cape Hatteras and Southern Florida (Bowman, 1971).
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LITERATURE CITED


Review of Scottocalanus securifrons


———. 1969. Some calanoid copepods collected chiefly by the U.S.


A NOTE ON THE OCCURRENCE OF *Scolecithricella tropica* GRICE (CALANOIDA: SCOLECITHRICIDAE) IN THE INDIAN OCEAN - A NEW RECORD

**ABSTRACT**

*Scolecithricella tropica* Grice is reported for the first time from the Indian Ocean. The similarities between the two species *Scolecithricella tropica* and *Scolecithricella beata* are obvious enough to consider them synonymous, hence the specimens recorded here are assigned to the former species which was described first.

Grice (1962) described the species *Scolecithricella tropica* in his account of the Calanoid copepods from the equatorial water of the Pacific Ocean. During the study of copepods from the Indian Ocean, one female specimen from station Ka. II, position 04°57'S, 77°59'E and four female specimens from station Um. 6312, position 21°34'S, 112°50'E (IOBC 1969), collected during the International Indian Ocean Expedition (IIOE) were identified as *Scolecithricella tropica* and these are reported here as the first record of this species from the Indian Ocean.

As described by Grice, these specimens can easily be identified from the structure of the posterior thoracic margin and the fifth pair of feet. There is a notch on the posterior thoracic margin just anterior to the apex (Fig. 1 A, B). The fifth pair of feet show variations in a few specimens. In some the feet are symmetrical by having two approximately equal terminal spines (Fig. 1 E). Whereas in a few they are asymmetrical with 3 terminal spines on one side and 2 on the other (Fig. 1 F). Average length of the specimen is 1.2 mm.

Tanaka (1962) described the species *Scolecithricella beata* from the Sagami Bay (Izu Region), Middle Japan. On comparing the published descriptions of *Scolecithricella tropica* and *Scolecithricella beata* with those of the present species, a good agreement can be seen between these two and the specimens from the Indian Ocean reported here. The few differences observed are the following.

In the first maxilla (Fig. 1. C.) Grice has shown 8 setae on the first inner lobe, Tanaka has mentioned 11 setae and the specimens recorded here also have 11 setae. The third inner lobe of the same appendage in the specimens from the equatorial water of the Pacific has 3 setae, so also the Indian Ocean specimens, whereas Tanaka has mentioned only 1 seta. On the endopod of the second maxilla (Fig. 1 D) the IIOE specimens have 5 sensory and 3 worm-like appendages as described by Grice. Tanaka has mentioned only about worm-like appendages.
The similarities between the two species *Scolecithricella tropica* and *Scolecithricella beata* are obvious enough to consider them synonymous and so, the specimens recorded here have been identified as *Scolecithricella tropica* Grice, which was first described from the Pacific.

The author thanks Dr. G. D. Grice of Woods Hole Oceanographic Institution for confirming the identification.

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**REFERENCES**

