and the concept of concentric layered structure for a lipofuscin granule advanced on the basis of light microscopical observations be regarded extremely doubtful.

As the lysosome and lipofuscin granules are very much related[6,7] and they may even be identical,[8] it would also be significant to note that recently Capanna *et al.*[9] have stained the lysosomes in various tissues with silver hexamethylenetetramine following oxidation of the tissue sections with sodium periodate and their published pictures of this study did not show the lysosomes stained as circles. These findings further support the present observations of the avian brain, and so how the clear halo seen around the stained granules in the unoxidised sections could take up a positive stain in the human nervous lipofuscin[1,2] needs further examination.

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1. Nassar, T. K., Issidorides, M. and Shanklin, W. M., *Stain Technol.*, 1960, **35**, 15.
2. Issidorides, M. and Shanklin, W. M., *J. Anat. (London)*, 1961, **95**, 151.
3. D'Angelo, C., Issidorides, M. and Shanklin, W. M., *J. Comp. Neural.*, 1956, **106**, 487.
4. Pearse, A. G. E., *Histochemistry, Theoretical and Applied*, Churchill Ltd., London, 1960.
5. Samorajski, T., Keefe, J. R. and Ordy, J. M., *J. Cell. Biol.*, 1965, **26**, 779.
6. Hibbs, R. G., Ferrans, Y. J., Walsh, J. J. and Burch, G. E., *Anat. Rec.*, 1965, **153**, 173.
7. Samorajski, T., Ordy, J. M. and Keefe, J. R., *J. Gerontol.*, 1964, **19**, 262.
8. Srebro, Z., *J. Comp. Neurol.*, 1966, **126**, 65.
9. Capanna E, Civitelli, M. V., De Martino, C. and Procicchiani, G., *Experientia*, 1966, **22**, 114.

ON THE OCCURRENCE AND SEASONAL DISTRIBUTION OF *ACARTIA PLUMOSA* T. SCOTT (COPEPODA : CALANOIDA)—A NEW RECORD FOR THE WEST COAST OF INDIA

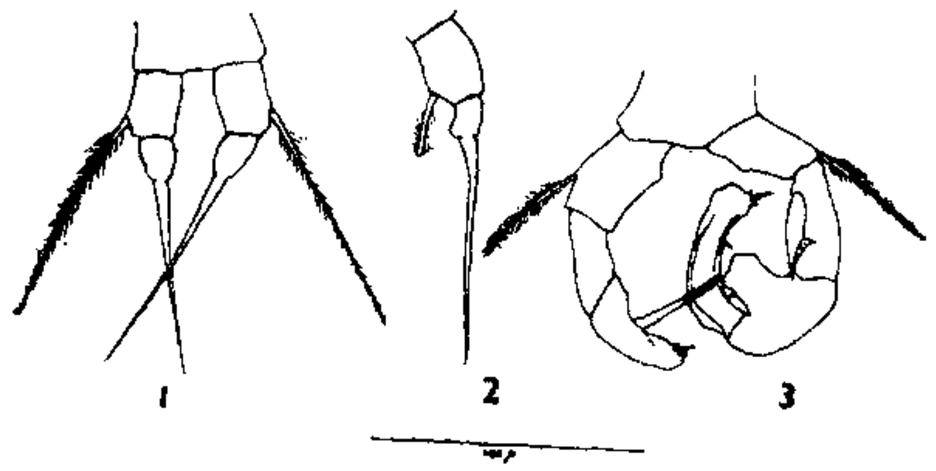
Acartia plumosa was first recorded from the Gulf of Guinea by T. Scott in 1894 ;[1] later from Salt Lakes, Calcutta, by Sewell in 1932[2] and from Sea of Japan by Brodsky in 1950.[3] In plankton collections taken from the Cochin Backwater (Lat. 9° 58′ N., Long. 76° 17′ E.) during 1968-69, this species was found to occur in considerable numbers in January and February. From then onwards its numbers dwindled till it was totally absent in July and August. It started appearing again in September, and in October and November the family Acartiidæ in the plankton was represented by *A. plumosa* only.

In collections taken from Fairway Buoy, a typically marine area about 3 miles west of Cochin Barmouth, this species was found irregularly in negligible numbers.

Size variation was noticed in those from the Backwaters ; larger specimens being found in October and November and smaller specimens during the rest of the year.

♀ 1·1 mm.	♂ 1·0 mm. (larger)
♀ 0·9 mm.	♂ 0·85 mm. (smaller)

Salient Features.—Small spines on the posterior corners of the 5th pedigerous segment in both sexes. Caudal rami long in female, longer than the last urosome segment. 3rd segment of the female fifth leg has a shelf-like projection in its proximal posterior part (Figs. 1 and 2). Scott's illustration shows a suture distal to this shelf and he refers to the part distal to this suture as 'apical seta'. This suture is not present in this species and the 'apical seta' is the distal part of the 3rd segment beyond the shelf. Brodsky (1950, Fig. 299) shows no suture in this position.



FIGS. 1–3. *Acartia plumosa* T. Scott. Fig. 1. Female fifth feet, anrerior view. Fig. 2. Female fifth feet, posterio-lateral view. Fig. 3. Male fifth feet.

A. southwelli Sewell (1914),[4] *A. chilkœnsis* Sewell (1919)[5] and *A. bilobata* Abraham (1969)[6] were found together with *A. plumosa* in the plankton collections taken from Cochin Backwaters and Fairway Buoy. The last three species are referable to Steuer's[7] subgenus *Acanthacartia*. General appearance of the males of these four species is so similar that a correct identification is difficult without intensive study. There are three outstanding characters by which the male of *A. plumosa* can be distinguished from those of the other species : right fifth leg much longer than left ; the spine on the midlength of the inner margin

of the last segment of left fifth leg is long and spinulose [Scott (1894) observed no spinules on this spine]; the inner projection on the 3rd segment of the right fifth leg is roughly quadrilateral (Fig. 3), while that of *A. southwelli* is evenly rounded, that of *A. chilkœnsis* has a distal process and that of *A. bilobata* is bilobed.

A systematic study of the family Acartiidæ of Cochin Backwaters has enabled the author to record 11 species of this family so far.

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1. Scott, T., *Trans. Linn. Soc. London, Zoology*, 1894, **6** (1 & II).
2. Sewell, R. S. S., *Mem. Indian Mus.*, 1932, **10**, 395.
3. Brodsky, K. A., *Opred. faune SSSR, Ind. Zool. Inst. Akad. Nauk. SSSR*, 1950, **35**, 1.
4. Sewell, R. B. S., *Spolia Zeylanica*, 1914, **9**, 244.
5. —, *Rec. Indian Mus.*, 1919, **5**.
6. Abraham, S., *Crustaceana*, 1969 (In press).
7. Steuer, A., *Zool. Anz.*, 1915, **45** (9), 392.

A REPORT OF CRASSULACEAN ACID METABOLISM IN *EUPHORBIA CADUCIFOLIA* HAINES AND ITS DIVERSITY

The leafy spurge (*Euphorbia caducifolia*) shows morphological diversity.[4] The physiological diversity in germination of seeds has also been reported in this species.[5] The diversity is also seen in the leaves, which are fleshy and caducous. These leaves are sour and the sour taste does not appear to be equal in the leaves of different individual plants, thus indicating a diversity in the accumulation of acids. The phenomenon of diurnal fluctuation of acidity in the succulent leaves of *Bryophyllum*, termed crassulacean acid metabolism, is also exhibited by all those non-succulent plants which possess high concentration of organic acids.[1-3] Investigations on *E. caducifolia*, which is probably the only species in this genus to have sour leaves, showed only accumulation of acids in them. For the present study, two things have been kept in view: first, how far the acid metabolism of this species stood comparison with the crassulacean type, and second, the diversity with regard to the metabolism of acids in different individual plants.

Samples were collected from two individual plants, one with small lanceolate (S) and the other with large rounded (L) leaves. The plants were specially cultivated in pots for this purpose. The acidity of leaves was expressed in terms of titrable acid number (T. A. N.). For this, 1 g. of fresh leaves were weighed, extracted in 50% alcohol and then in distilled water. The filtrate was titrated against N/50 CO_2-free NaOH using methyl red as indicator. The volume of NaOH required to neutralise the acid present in 1 g. of fresh leaves is expressed as T.A.N.

As the values of T.A.N. indicate only a measure of total acidity, changes in the different acid constituents in the leaf were observed by ascending paper chromatography. The solvent system of *n*-butanol : formic acid : water (10 : 3 : 10) was used for this purpose. Ammoniacal silver nitrate (equal parts of 0·1 N $AgNO_3$ and 0·1 N NH_4OH, prepared freshly) was used as the spraying reagent.[2] The leaf extract for spotting a chromatogram was prepared by digesting 1 g. leaf sample with 10 ml. of 70% alcohol. Different reference solutions of ascorbic, citric, fumaric, malic, oxalic, succinic and tartaric acids were placed to serve as standard on the chromatograms.

For sugars (monosaccharides), the leaves were extracted in 80% alcohol with subsequent clarifications in lead acetate and disodium hydrogen phosphate.[6] pH was determined by an electronic pH meter. All the above-mentioned estimations for fully mature leaves in the month of September in case of two selected plants (S and L) during the day are given in Table I.

Chromatograms of leaf extracts showed the changes in the different acid constituents in leaves to be mainly malic and citric. Following points become evident from Table I.

1. T.A.N. is highest in the leaves after the period of night darkness in the early morning.
2. Total acid percentage increases during the dark period and is maximum early in the morning which reaches a minimum in the evening.
3. pH values of the leaf changed during the day hours.
4. Among the carbohydrates, only monosaccharides were detected, which were maximum in the evening and minimum early in the morning after the darkness of the night.
5. Both malic and citric acids appeared to be utilized during the day hours in sunlight and their concentration was maximum after the dark period of the night.