0.24 μ to 2.00 μ with an average of 1.2 μ in diameter.

Our observation showed that some of the *S. litura* that died at a later stage, without body shrinkage, were found to contain capsules of GV along with polyhedra of CPV. In these cases, the whitening of the body was visible not only on the ventral side but in the body as a whole (figure 3). Similarly, some of the larvae, which died at a later stage showed double infections of NPV and GV. Here mostly the skin breaking was noticed. The dead cadavers revealed both big-sized and irregular-shaped polyhedra of NPV, unlike those of small inclusion bodies of CPV along with capsules of GV. Though the occurrence of NPV has been reported by Ramakrishnan and Tiwari[5] and GV by Narayanan[6] in *S. litura*,this appears to be the first record of CPV, and CPV along with NPV, CPV with GV and NPV with GV. Mixed virus infections in insects are not uncommon in nature. Similar mixed infections have been observed in many lepidopterous larvae for NPV and GV in *Agrotis segetum* and NPV and CPV in *Bombyx mori* and with CPV and GV in *A. segetum*[1]. Mixed infection of viruses is possible in one and the same larvae, due to the difference in the organs attacked, and the site of virus multiplication. In the case of CPV, the mid-gut is the main site of infection unlike that of GV which was mostly found in the fat bodies, representing mono-organotrophic nature of GV. In the case of NPV, the skin is one of the main organs attacked leading to the fragile nature of the body and rupturing of the body contents with the slightest touch. From the observation, it has been found that mostly grown up caterpillars were found infected with mixed infection of NPV and GV and CPV and NPV, possibly suggesting that there must be some sort of interaction leading to synergism or antagonism resulting the death only in the later stages.

Our thanks are due to Dr Gerard M. Thomas, University of California for his help in confirming our identity of the pathogens.

14 May 1985; Revised 11 July 1985

1. Krieg, A., In: *Microbial control of insects and mites*, (eds) H. D. Burges and N. W. Hussey, 1971, Academic press, New York, p. 759.
2. Jacob, A., Thomas, M. J. and Chandrika, S., *Agric. Res. J. Kerala*, 1972, **10**, 65.
3. Narayanan, K. and Jayaraj, S., *Curr. Sci.*, 1979, **48**, 825.
4. Sikorowski, P., Broome, J. R. and Andrews, G. L., *J. Invertebr. Pathol*, 1971, **17**, 451.
5. Ramakrishnan, N. and Tiwari, L. D., *Indian J. Entomol.*, 1969, **31**, 191.
6. Narayanan, K., *Curr. Sci.*, 1985 (in press).

SEXUAL DIMORPHISM IN THE PONYFISH, *LEIOGNATHUS BINDUS* (VAL)

N. JAYABALAN* and K. RAMAMOORTHI
Centre of Advanced Study in Marine Biology, Parangipettai 608 502, India.
* *Department of Fishery Biology, College of Fisheries, Mangalore 575 002, India.*

REPORTS on sexual dimorphism in teleost fishes are scanty. The present note records the first known sexual dimorphic character in *Leiognathus bindus* (Family Leiognathidae) (figure 1).

Leiognathids have a well developed internal luminescent system with a light organ[1]. The outer surface of the light organ in male *L. bindus* is densely pigmented with melanophores and is visible to the exterior as a black spot close to the pectoral fin base where the muscle is transparent (figure 1a). In the female, there is no transparent region under the pectoral fin and hence, the light organ is not visible (figure 1b). This helps to distinguish the sexes. A total of 860 specimens of sizes ranging from 41mm to 109 mm, total length (T.L.), landed by trawlnets,

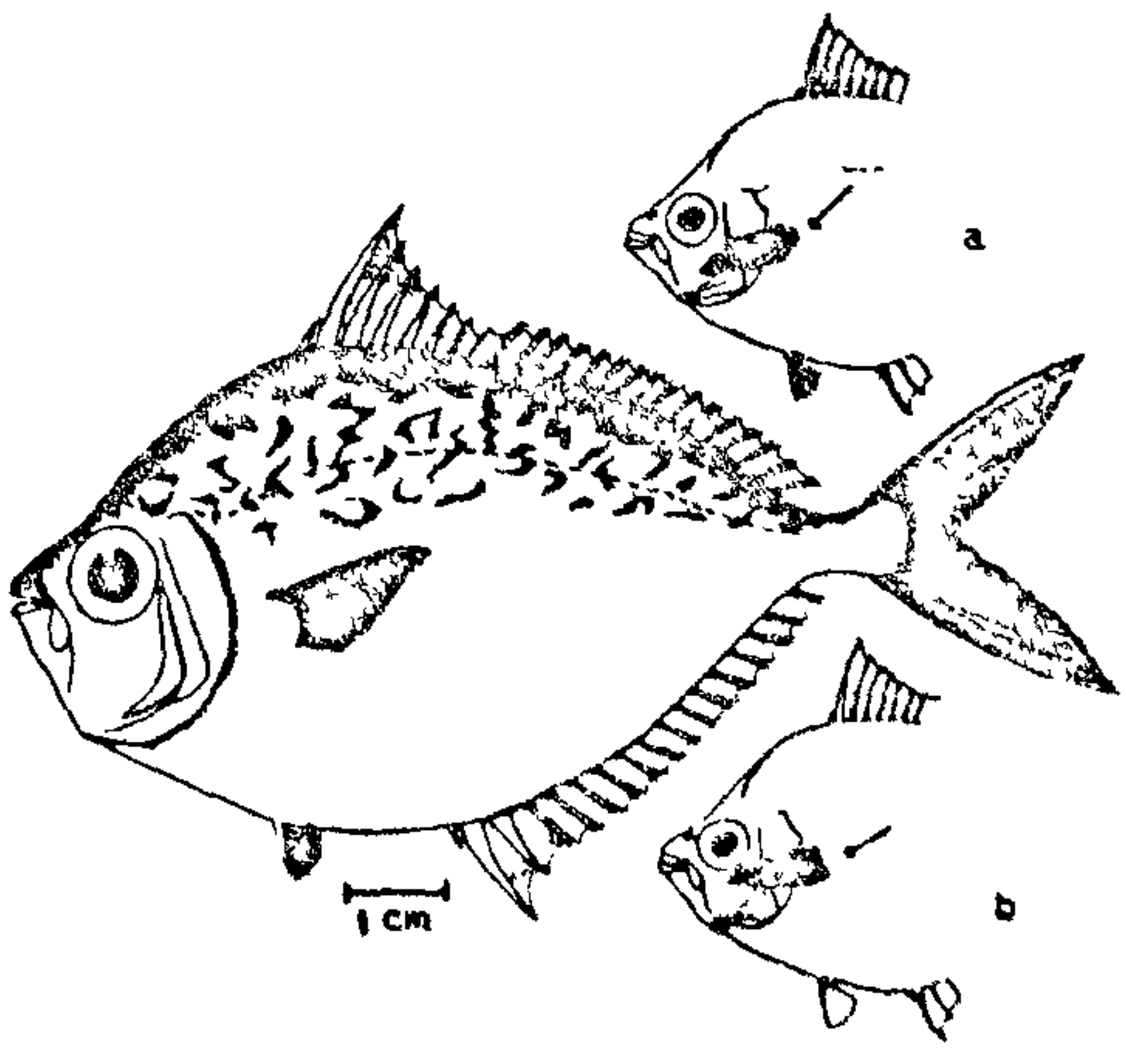


Figure 1. Sexual dimorphism in *Leiognathus bindus* (Val) **a.** male and **b.** female

gillnets, cast-nets and shore-seines at the Porto Novo fish landing centre (Lat. 11° 29′ N and Long. 79 46′ E) were utilized for external sex identification.

In *L. bindus*, the body form, morphometrics, meristics and colouration are identical in both the sexes, and it is not surprising that earlier workers overlooked the sexual dimorphism.

The authors are thankful to UGC, New Delhi for financial support to NJ.

25 May 1985; Revised 5 August 1985

1. Haneda, Y. and Tsuji, F. I., *J. Morphol.*, 1976, **150**, 539

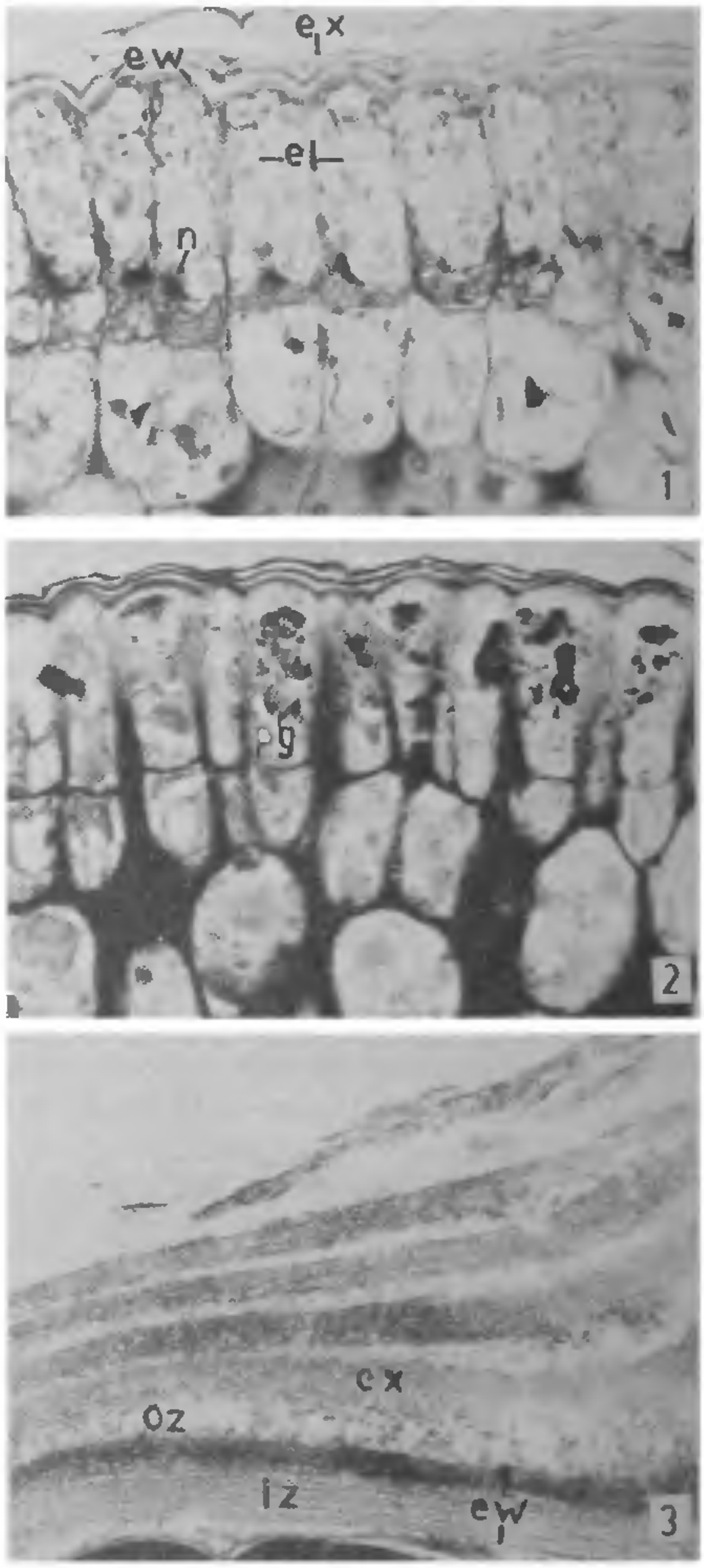
EXTRACELLULAR POLYSACCHARIDES IN *TURBINARIA CONOIDES*: STRUCTURE AND ULTRASTRUCTURE

GUNWANT SOKHI and
M. R. VIJAYARAGHAVAN
Department of Botany, University of Delhi, Delhi 110007, India.

BROWN seaweeds are known to secrete a variety of substances such as polysaccharides, organic acids, peptides and tannins. The four major polysaccharides reported in brown algae are: alginic acid, cellulose, sulphated polysaccharides and laminarin[1]. The present investigation on *Turbinaria conoides* Kütz deals with the histochemistry and ultrastructure of epidermal cells and epidermal extracellular products.

T. conoides was collected during low-tide period from Okha Port (Gujarat). The apical portions of the thalli and conceptacles were fixed on the spot, in 10% aqueous acrolein[2], post-fixed in 1% mercuric chloride[3], dehydrated in methoxyethanol series, infiltrated and embedded in glycol methacrylate plastic mixture. Two micron sections were cut using glass knives and stained either with PAS reagent and aniline blue-black or 0.05% toluidine blue[2] 0 at pH 4.4 or 0.5% alcian-blue[4] at pH 0.5.

For electron microscopy 1 mm cut receptacle tissues were fixed in 6% glutaraldehyde prepared in 0.025 M phosphate buffer at pH 6.8; post-fixed in 2% osmium tetroxide in 0.025 M phosphate buffer at pH 6.8. Dehydration was done in cold ethanol series, infiltration and embedding in Epon-araldite plastic mixtures[5]. Ultrathin sections, cut using glass knives on



Figures 1–3. Histochemistry and ultrastructure of epidermal and extracellular layers. (el, epidermal layer; ew, epidermal wall; ex, extracellular layer; iz, inner zone; n, nucleus; oz, outer zone; pg, polysaccharide granules). **1.** A portion of epidermal layer showing three extracellular layers overlying the outer tangential wall of the epidermal cell. Vacuoles contain polysaccharide granules. PAS and aniline blue-black × 780. **2.** A portion of the epidermal layer showing polysaccharide granules of varying size, TBO × 780. **3.** Electron micrograph showing two microfibrillar zones of outer tangential wall of the epidermal cell. The extracellular layers are separated from the epidermal cell wall by a space filled with microfibrils and vacuoles × 14200.