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A NEW BRYOZOAN SPECIES FROM THE SHELF SEDIMENTS OFF THE EAST COAST OF INDIA

THE bryozoan assemblage of the shelf sediments from off Visakhapatnam, east coast of India, has been described (Subba Rao and Kameswara Rao, 1970)[1]. The assemblage was reported to have included a new species of *Lacrimula*, a genus erected by Cook (1966)[2]. It is the purpose of this note to describe the morphology of the new species now christened *Lacrimula visakhensis*. The specific name, *visakhensis*, is derived from the port of Visakhapatnam, the nearest important coastal city from the location of its occurrence.

Genus *Lacrimula* Cook, 1966.

Lacrimula visakhensis Rao and Rao new species
(Figs. 1 A and 1 B)

Holotype and paratypes are preserved in the Micropalaeontology Laboratory, Geology Department, Andhra University, Waltair, India.

Dimensions (*Holotype*) :

Lz : 0·2–0·3 mm ; Wz : 0·23–0·40 mm ; Lor : 0·10–0·15 mm ; Wor : 0·10–0·15 mm ;

Lfo : 0·05–0·10 mm ; Wfo : 0·15–0·20 mm ; Lov : 0·35–0·45 mm ; Wov : 0·35–0·45 mm ; Lav : 0·15 mm ; Wav : 0·20 mm.

Length of Zoaria : 1·6–2·7 mm ; Width of Zoaria : 1·9–2·5 mm ;

Length of apical tube : 0·25–30 mm.

Description.—The length of the zoaria is nearly as much as the width at the widest part. Apical tube is long and rugose with kenozoecia ; Its base encircled by a row of small avicularia and a row of ovicells. Zooecia wide and the orifice rounded, with small condyles. Ovicells imperforate centrally and surrounded by a row of large, closely spaced pores. Avicularia nearly circular with long narrow condyles.

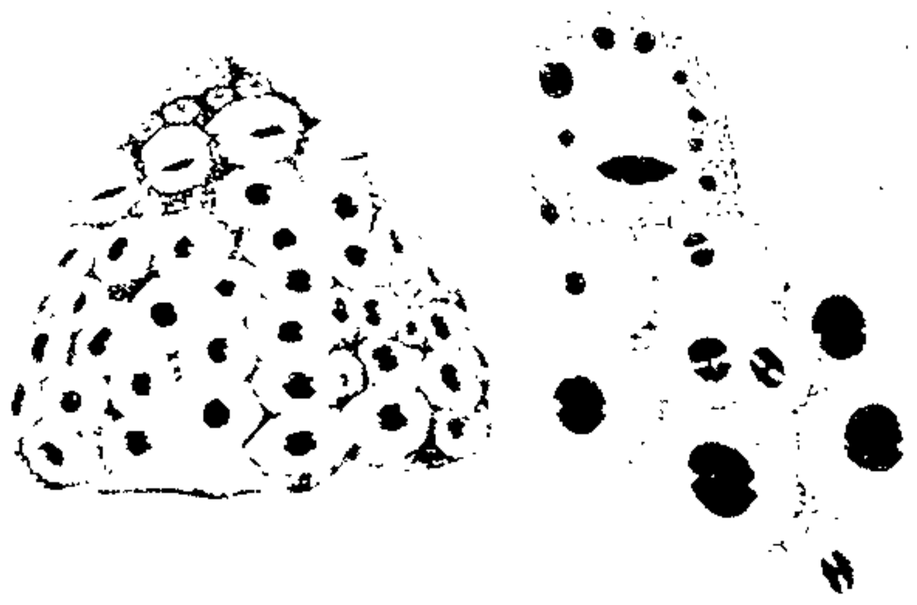

FIG. 1. *Lacrimula visakhensis*. A, a colony showing zooecia and orifices, × 50. B Ovicell, avicularia and zooecia, × 150.

Lacrimula visakhensis and *L. burrowsi* Cook are similar in many respects but show consistent differences : The width of zoaria in *L. visakhensis* is longer than in *L. burrowsi* but the range of Zoarial length is shorter than in *L. burrowsi*. Though the length of the zooecia is the same, they are wider, and their orifices rounder, with small condyles for articulation of the operculum. Avicularia are not short and wide but circular. Ovicells are longer than those of *L. burrowsi*. Their central area imperforate and surrounded by marginal pores. Fertile orifice is short and wide, the condyles being invisible externally. Apical tube is surrounded by only one row of avicularia which is followed by a row of ovicells. The apical tube is nearly equal in length to that of *L. pyriformis* Cook.

Occurrence.—The specimens of *Lacrimula visakhensis* have been recovered from the continental shelf sediments off Visakhapatnam, east coast of India, at depths of 60–200 metres. The sediments in which they were found are clayey sands or sand-silt-clays which may date as back as 10,800 ± 55 years B.P. (Naidu, 1968)[3].

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EFFECT OF SOIL PHENOLICS ON THE GROWTH OF *RHIZOBIUM*

SEVERAL factors influence the growth and survival of *Rhizobium* sp. in soil. Natural fungistasis in soil, occurrence of mineral elements like copper and zinc and the inhibitory compounds on the seed coats of leguminous plants have been observed to be detrimental to *Rhizobium* sp. in soil[1-3]. The mere aqueous extract of soil is reported to exhibit inhibitory activity towards *R. lupini*[4]. Soils contain many phenolic compounds like cinnamic, ferulic, *p*-amino benzoic, *p*-hydroxy benzoic, syringic and vanillic acids due to the degradation of organic residues[5,6]. Phenolics when they accumulate in high concentrations in soil might be harmful to rhizobia and other beneficial microflora. In this paper the effect of certain soil phenolics on the growth of *Rhizobium* sp. is reported.

One hundred g each of black soil (from Coimbatore), red soil (from Coimbatore), lignite (from Neyveli) and peat soil (from the Nilgiris) were extracted in cold with 250 ml of 80% ethyl alcohol following the methods of Wang *et al.*[7]. The final condensed residue was taken in 3·0 ml of distilled methanol and 100 μl aliquots were spotted on Whatman No. 1 chromatographic paper and developed in a solvent system of *iso*-propanol : ammonia : water :: 10 : 1 : 1 (v/v)[8]. Alkaline diazotised sulphanilic acid (DSA) and alcoholic ferric chloride were used as spray reagents. Co-chromatography of authentic samples of phenols and colour reactions with the spray reagents helped in the identification of unknowns. Quantitative estimation of total phenolics was done following the procedures of Bray and Thorpe[9] using Folin-ciocalten reagent.

The effect of certain phenolic compounds on the *in vitro* growth of *Rhizobium* sp. (TNAU isolate No. 22 from peanut root nodules) was studied by incorporating the phenols at various concentrations in the liquid medium (Waksman No. 79). Standardized quantity of the cell suspension of *Rhizobium* sp. (0·1 ml containing Ca 10^6 cells) was inoculated and the flasks were incubated at 28° C for 72 hr on a rotary shaker. The growth of the bacterium was measured in a Spectronic-20 colorimeter at 610 mμ using appropriate checks.

The results (Table I) indicate that of the four soil types examined, lignite contained maximum quantity

TABLE I
Phenolic content of four soil samples*

Soils	pH	Total phenols (μg/g of oven dry soil)
Black soil	6·9	0·127
Lignite	5·2	0·421
Peat soil	4·8	0·254
Red soil	7·0	0·246

* Expressed in catechol equivalents.

of total phenols, besides the five phenolic acids (Fig. 1). Only two compounds were present in

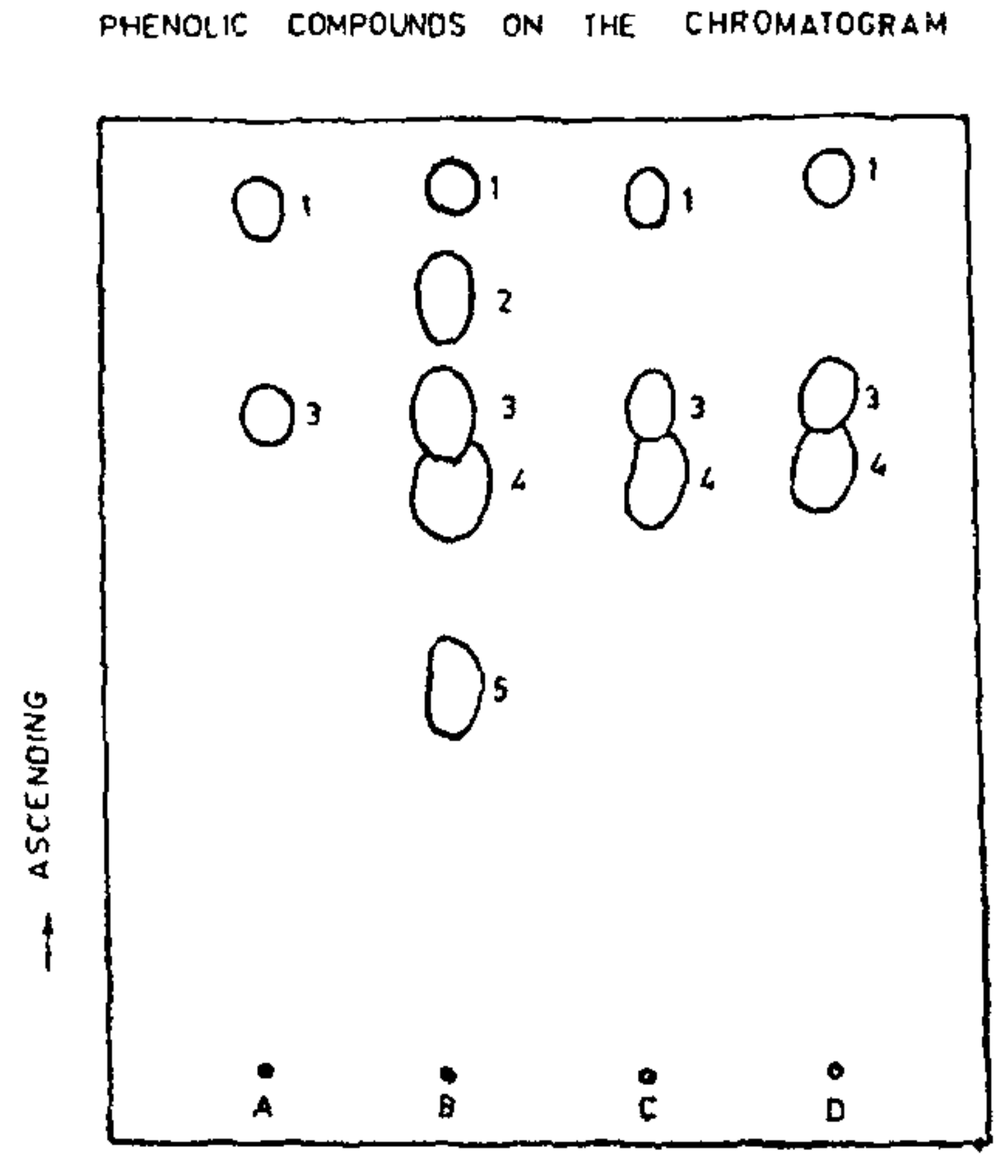

FIG. 1. A. Black soil. B. Lignite. C. Peat soil. D. Red soil. 1, *p*-hydroxy benzoic acid. 2, *p*-amino benzoic acid. 3, *p*-coumaric acid. 4, Syringic acid. 5, Cinnamic acid.

black soil and three each in red and peat soil. *p*-Amino benzoic acid and cinnamic acid were the two additional phenolics found in lignite. It has been observed that all the phenols tested *in vitro* inhibited the growth of *Rhizobium* sp. (Table II) even at 0·0005 M concentration. *p*-Amino benzoic acid and hydroquinone were more inhibitory than others. Kandasamy and Prasad[10] recently reported that lignite could serve as a good carrier for rhizobia. However, the results of the present investigation indicate that as lignite contains more quantities of phenolic than other soils do, it may