

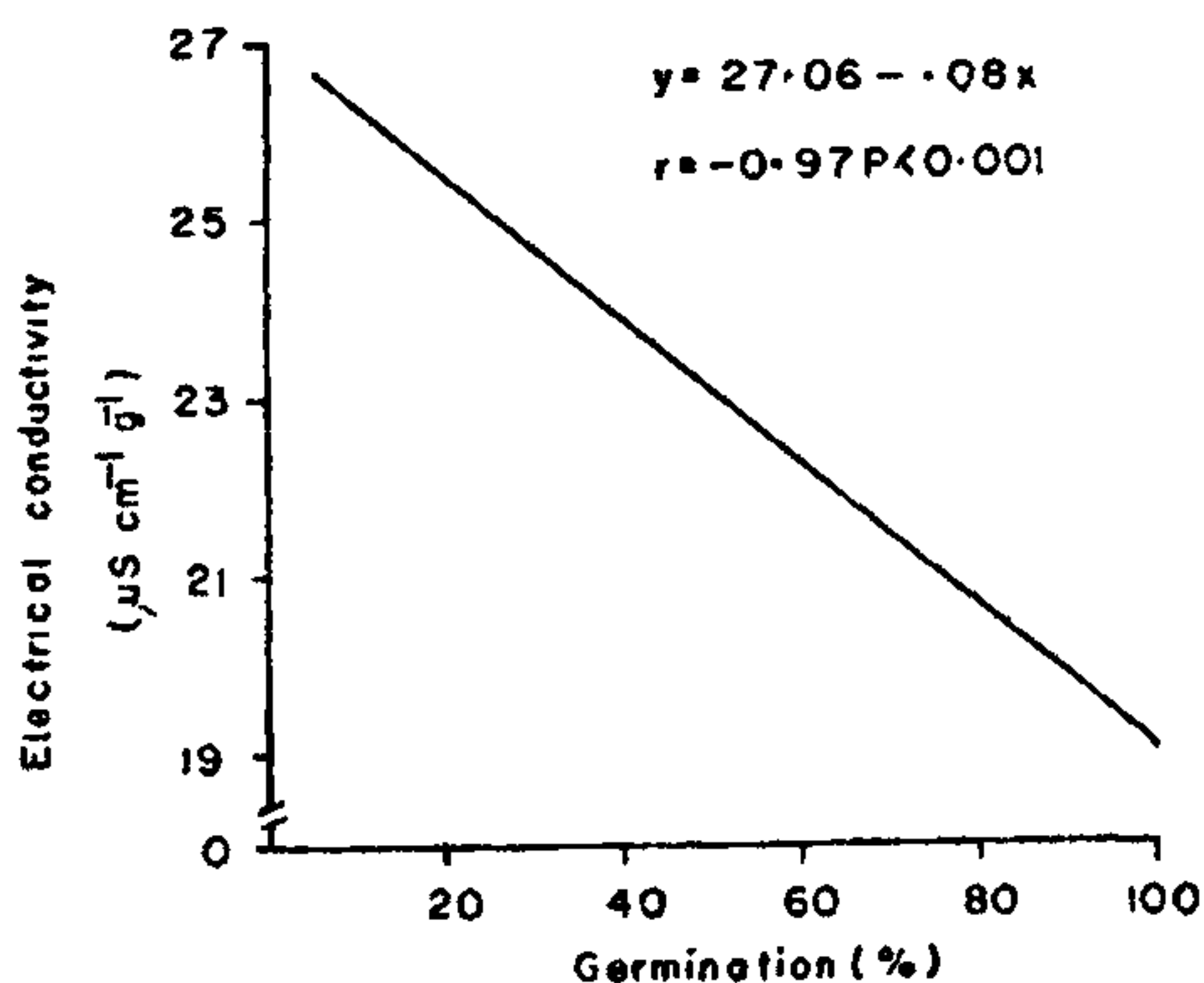
**Table 1** Germination classes and electrical conductivity in different lots of Sal seeds

Seed lot No.	Germination (%)	Mean electrical conductivity ( $\mu\text{s cm}^{-1}\text{g}^{-1}$ )
1	1-10	28.37
2	10-20	25.37
3	20-30	24.72
4	30-40	23.66
5	40-50	22.79
6	50-60	22.54
7	60-70	21.94
8	70-80	21.34
9	80-90	20.43
10	90-100	19.44

Germination classes were made (1-100%) from different seed lots and mean values of electrical conductivity were calculated for each class (table 1). Results indicate a gradual increase in electrolyte leakage as the germination decreases. Statistical analysis showed significant negative relationship ( $r = -0.97$   $P < 0.001$ ) between seed germination and electrical conductivity (figure 1).

In the present investigation the range of electrical conductivity in viable Sal seeds seems to be narrow ( $19.44$  to  $28.37 \mu\text{s cm}^{-1}\text{g}^{-1}$ ) whereas the Official Seed Testing Station for England and Wales suggested a wide range for many crop seeds (24 or less to  $44 \mu\text{s cm}^{-1}\text{g}^{-1}$ )<sup>6</sup>.

Damage of cellular membrane is the first deteriorative factor in seeds and this is indicated by an



**Figure 1.** Regression line indicating the relationship of electrical conductance and germination in Sal seeds.

increase in electrolyte leakage<sup>7</sup>. In stored Sal seeds, membrane disruption increases with aging and the moisture content below 25% is a critical factor governing the viability of seeds<sup>8</sup>. However 20% moisture limit as a critical point for membrane integrity was reported in seeds when fast out flux of solutes takes place<sup>9,10</sup>.

On the basis of various studies made so far, membrane integrity in Sal seeds and solute leakage appears to be linked with their germination. The present study shows that germination of Sal seeds can be safely predicted on the basis of electrical conductivity.

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#### ADDITION OF TWO SPECIES OF THE GENUS *BULBOCHAETE* AGARDH (OEDOGONIALES, CHLOROPHYTA) TO INDIAN ALGAL FLORA

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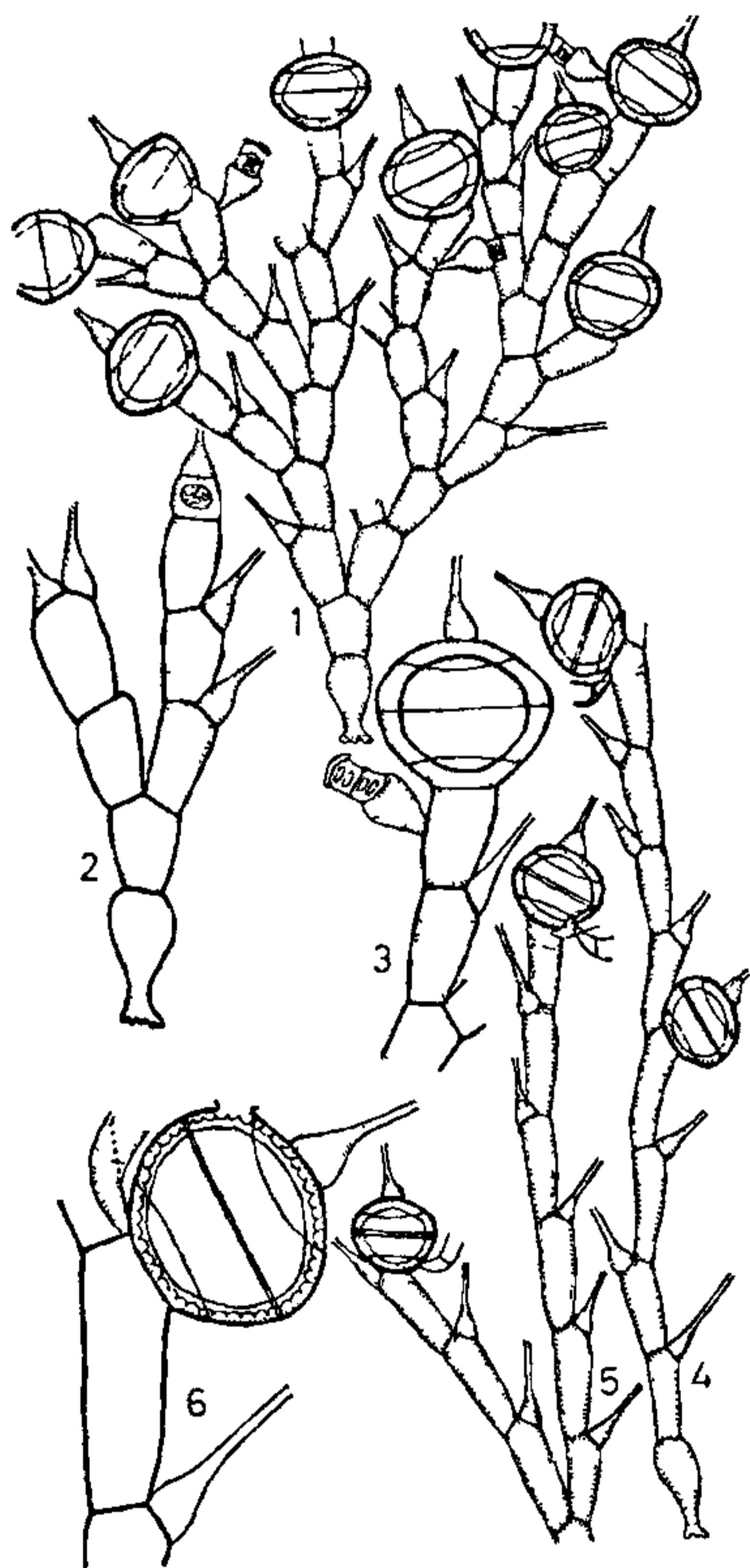
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The genus, *Bulbochaete* Agardh is known to have 109 species<sup>1,2</sup> and of these 45 species are known from India<sup>1,3</sup>. So far only five species<sup>4-6</sup> have been

reported from the northern part of the country. The present communication deals with two species of *Bulbochaete* viz. *B. triangularis* Jao and *B. polyandria* f. *polyandria* Hirn which also happen to be the first records from India. Both species were collected from Maun Lake (Pratapgarh), Uttar Pradesh during October–December 1984.

*Bulbochaete triangularis* Jao (figures 1–3) Thalli small in size, about 300  $\mu\text{m}$  long, nannandrous, idioandrosporous branching gregariously pseudo-dichotomous, vegetative cells slender and apically



**Figures 1–6** 1. *Bulbochaete triangularis* Jao showing gregariously pseudodichotomous branching; 2. Triangular globose cells with terminal setae; 3. Oogonium and androsporangium; 4. *Bulbochaete polyandria* f. *polyandria* Hirn showing subdepressed globose oogonia bearing setae; 5. Oogonia with nannandria; 6. Oospores completely filling oogonium with scrobiculated wall.

broad, with a distinct parietal chloroplast with two or three pyrenoids, cells 10–15  $\mu\text{m}$  in diameter and 18–30  $\mu\text{m}$  in length. Oogonium depressed and nearly triangular-globose shaped and present under the terminal seta or vegetative cells, formed in erect or rarely in patent position, suffultory cells showing basal division, 38–40  $\mu\text{m}$  in diameter and 28–33  $\mu\text{m}$  in length. Oospores identical in shape and nearly filling the oogonium. Oospore wall smooth, three-layered and laminated. Oospore 28–35  $\mu\text{m}$  in diameter, 25–30  $\mu\text{m}$  in length.

The androsporangia measure 9–11  $\mu\text{m}$  in diameter and 7–9  $\mu\text{m}$  in length. Nannandria small and attached on oogonium or suffultory cells, rarely on vegetative cells, 10–12  $\mu\text{m}$  in length. Antheridium single or two in exterior position, 5–6  $\mu\text{m}$  in diameter, 6  $\mu\text{m}$  in length.

This species was found attached to *Ceratophyllum* sp.

The present alga has characteristic oogonium and agree with its measurement, except the larger size of oogonium. Sometimes it is confused with *B. elatior* Hirn but the latter has much larger oogonium and vegetative cells with distinct globose or depressed globose shaped oogonium. So far the position of androsporangia has not been clearly known but in the present study it was observed under the terminal seta in a plant which did not bear oogonia, thereby indicating that the species is idioandrosporous.

*Bulbochaete polyandria* f. *polyandria* Hirn (figures 4–6).

Plants nannandrous, idioandrosporous, less branched and up to 1000  $\mu\text{m}$  long. Vegetative cells long, slender with a parietal chloroplast with up to 5 pyrenoids. Cells 10–18  $\mu\text{m}$  in diameter, 60–75  $\mu\text{m}$  in length; suffultory cell with superior division, rarely suprmedian. Oogonium subdepressed globose with patent position and always bearing a terminal seta, 40–45  $\mu\text{m}$  in diameter, 42–47  $\mu\text{m}$  in length. Oospores identical in shape, completely filling to oogonium and three-layered, outer layer scrobiculated or nearly smooth and others smooth and thin-walled. 37–42  $\mu\text{m}$  in diameter and 38–44  $\mu\text{m}$  in length. Androsporangia single or two, patent 13–15  $\mu\text{m}$  in diameter, 10–15  $\mu\text{m}$  in length. Nannandria small, slightly curved, Often present on oogonia, measuring 8–10  $\mu\text{m}$  in diameter, 20–25  $\mu\text{m}$  in length. Antheridia produced single or two in number with interior position and measuring 6–10  $\mu\text{m}$  in diameter, 4–6  $\mu\text{m}$  in length.

It was found growing attached to *Chara* sp. and *Ipomea* sp.

This alga agrees with the described species in all the characteristic features.

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#### OCCURRENCE OF A CLADOCERAN SWARM IN THE LOWER STRETCH OF HOOGLHY ESTUARY, WEST BENGAL, INDIA

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CLADOCERANS are important groups of zooplankton which are useful as indicator species<sup>1</sup>. Incidence of a cladocera *Evadne tergestina* Claus with reference to prevailing hydrographical parameters was studied in the lower stretch of Hooghly estuary. Surface zooplankton samples were collected fortnightly at forenoon hours during high tide from a selected station situated in the northern part of the Hooghly estuary funnel from March 1980 to February 1981. Measured quantities of surface water were filtered through a conical net (0.25 m diameter and 0.0695 mm aperture) and preserved in 4% buffered formaldehyde in seawater. In the laboratory, aliquot samples were taken in a Sedgewick Rafter plankton counting cell under a compound microscope for different numerical analyses. Water samples were also collected to determine various hydrological parameters adopting the methods outlined by Strickland and Parsons<sup>2</sup>.

Cladocerans were more common during high saline period and were absent in the estuary during monsoon period (July to October) with the water temperature and salinity of 29.7° to 31.1°C and 1.66

to 6.94‰ respectively. They showed discontinuity in their temporal distribution in very small numbers, bursting into blooms (185 no./m<sup>3</sup>) in June 1980 with the water temperature 31 to 31.5°C, salinity 15.79 to 24.97‰, dissolved oxygen 2.6 to 2.8 ml/l and pH 8.2. The increased turbidity during monsoon might induce the total absence of cladocera when the density of the green algae and the cladoceran food became very poor in turbid waters<sup>3</sup>. Cladoceran abundance in the plankton off Calicut was recorded when the temperature and salinity ranged<sup>4</sup> respectively between 24.4° to 26.5°C and 30.5 to 33.3‰. In the Cochin region, George<sup>5</sup> observed *Evadne* sp in large numbers in the plankton from July to September, when the salinity was low. Selvakumar<sup>6</sup> observed a direct relationship of cladoceran swarms with mackerel fishery along the west coast of India. Pillai and Pillai<sup>7</sup> observed that the distribution of *E. tergestina* was more or less the same throughout the year with their peak coinciding with the post-monsoon months (September to October). Nair *et al*<sup>8</sup> recorded *Evadne* sp and *Diaphanosoma* sp from Kadinamkulum backwaters with the maximum number in February and May. The reason for such sudden swarming of cladocerans is attributed to their capacity to proliferate by parthenogenesis<sup>9</sup>.

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