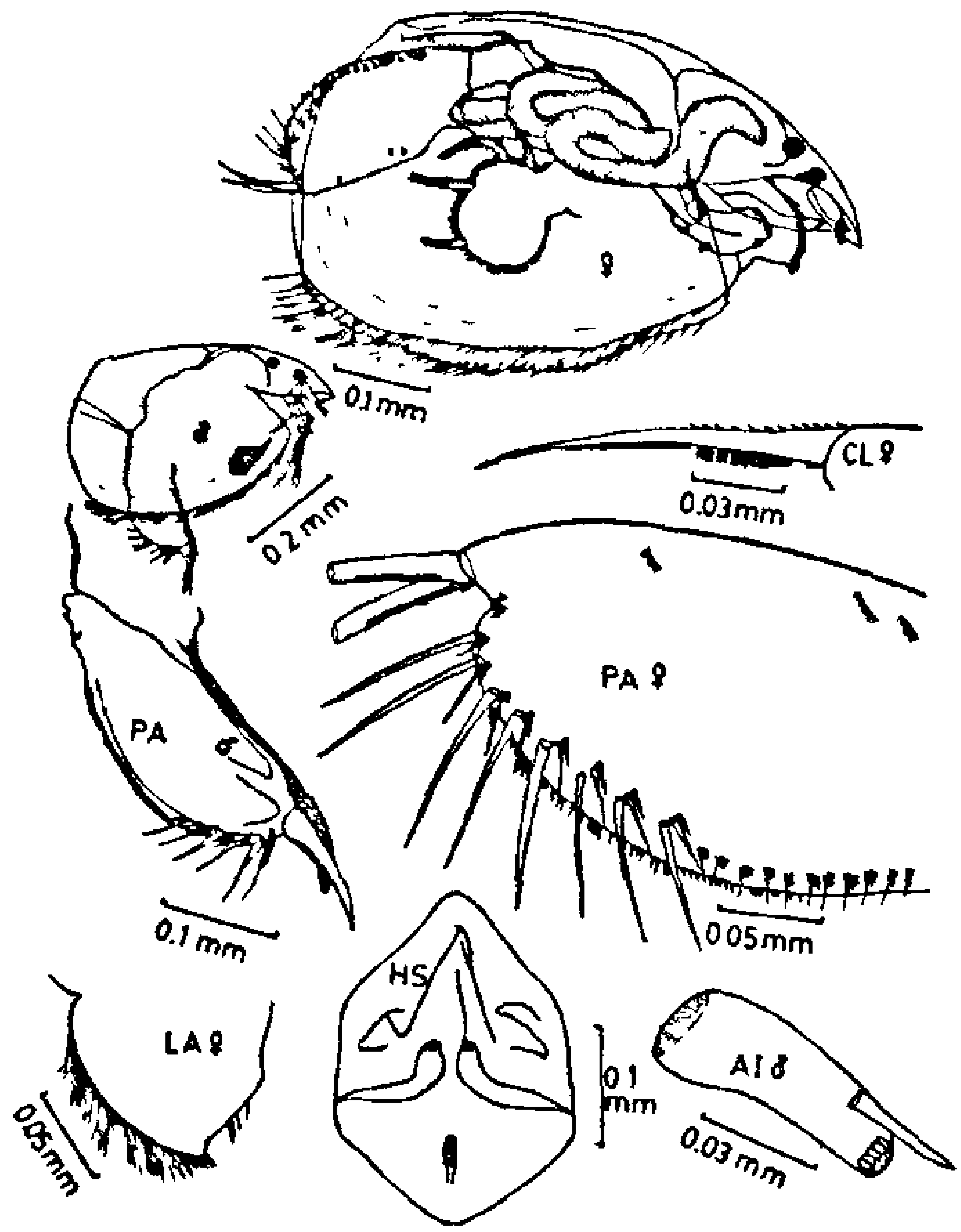

Figure 3. *Leydigia ciliata*, Female and Male: AI-antennule; LA-labrum; PA-postabdomen; CL-claw; HS-headshield.

main headpores are connected and two lateral pores at the sides of the middle pores are present.

The male resembles the female in all respects except in the following features. The size of the male is smaller than the female. The first antennule of male is provided with a spear shaped cilia. First leg is provided with well developed hook. On the ventral side of the postabdomen, a penislike vas-deferens hangs down in between the two claws (figures 2, 3).

L. ciliata is reported from the Ethiopian region[4,5], Neotropical region[6,7] and Central Asia[8-11].

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RELATIONSHIPS OF DEMERSAL PRODUCTION IN KARWAR WATERS

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THE demersal fish production is the consequence of a long food chain involving four major steps. First, the death and decay of phytoplanktonic organisms produce richly nutritive detritus which collects over the seabed as a form of organic matter unassimilable for most pelagic animals[1]. Secondly, the detritivorous meio and macrobenthos (62 to 500 and > 500 μ sized sediment dwellers respectively) utilise the detritus for the production of biomass[2]. Thirdly, the benthic invertebrates are fed upon by the demersal fish whose nutritive quality is a direct indication of productivity of the bottom environment[3]. Lastly, the detritus and the fecal pellets of benthic metazoans are infested by microbenthos (mainly bacteria) which regenerate the nutrients into water thereby assisting the planktonic production and also diatomic production at meiobenthic level[1]. Summarising, the gross demersal production depends entirely on the biomasses and production at planktonic and benthic levels along with the available amount of nutrients for the metabolic activity of plankton.

In this paper, it has been attempted to indicate the various elements of demersal food chain in Karwar waters (14°50′N and 74°07′E), covering an area of 32 km^2.

The present study was conducted during March

1980 to March 1982. The collection, identification and quantification of biomass and production of benthos were carried out according to the methods discussed by Holme and McIntyre[4]. While the collection, identification and estimation of plankton were done as per Wickstead[5], the biomass and primary production were calculated according to Strickland[6]. The data on sciaenid landings were obtained from the landing centres with the help of Karnataka Fisheries Department. The fish were identified according to FAO/UN[7] and Lal[8] and the production was calculated by using the method given by Ricker[9]. Nutrient composition of water was determined according to Strickland and Parsons[10]. While suspended load of bottom water was checked with a turbidity meter, the method described by El Wakeel and Riley[11] was used to find sediment organic carbon and organic matter content in the suspended load.

Figure 1 gives the basic network of the components of demersal food chain in Karwar waters.

The phytoplankton was mainly composed of members of Bacillariophyceae (70%) and Dinophyceae (19%) with a species each from Cyanophyceae, Haptophyceae and Chrysophyceae, and were characterised by the species of *Coscinodiscus*, *Thalassiothrix*, *Gyrosigma*, *Chaetoceros*, *Asterionella*, *Biddulphia*, *Planktoniella* and *Ceratium*, which comprised more than 50% of the biomass. The gross primary production by phytoplankton ranged from 105.2 to 2125.8 g $Cm^{-3}yr^{-1}$ with an annual mean of 1194.1 g $Cm^{-3}yr^{-1}$. Though a large part of this production went into the pelagic food chain (through zooplankton), a definite part being proportional to the biomass of total phytoplankton rained as detritus to the seabed. This is reflected by the variation in suspended load and its organic matter content above the seabed which had the same trend of variation as that of the phytoplankton. Moreover, a higher grazing by the zooplankton at the surface, delinking most part of the plankton biomass with the demersal food chain increases the fecal production of the zooplankton proportional to the grazing effect. Therefore, there is a firm evidence to believe that the periodic inclusion of detritus into demersal food chain was proportional to the planktonic biomass.

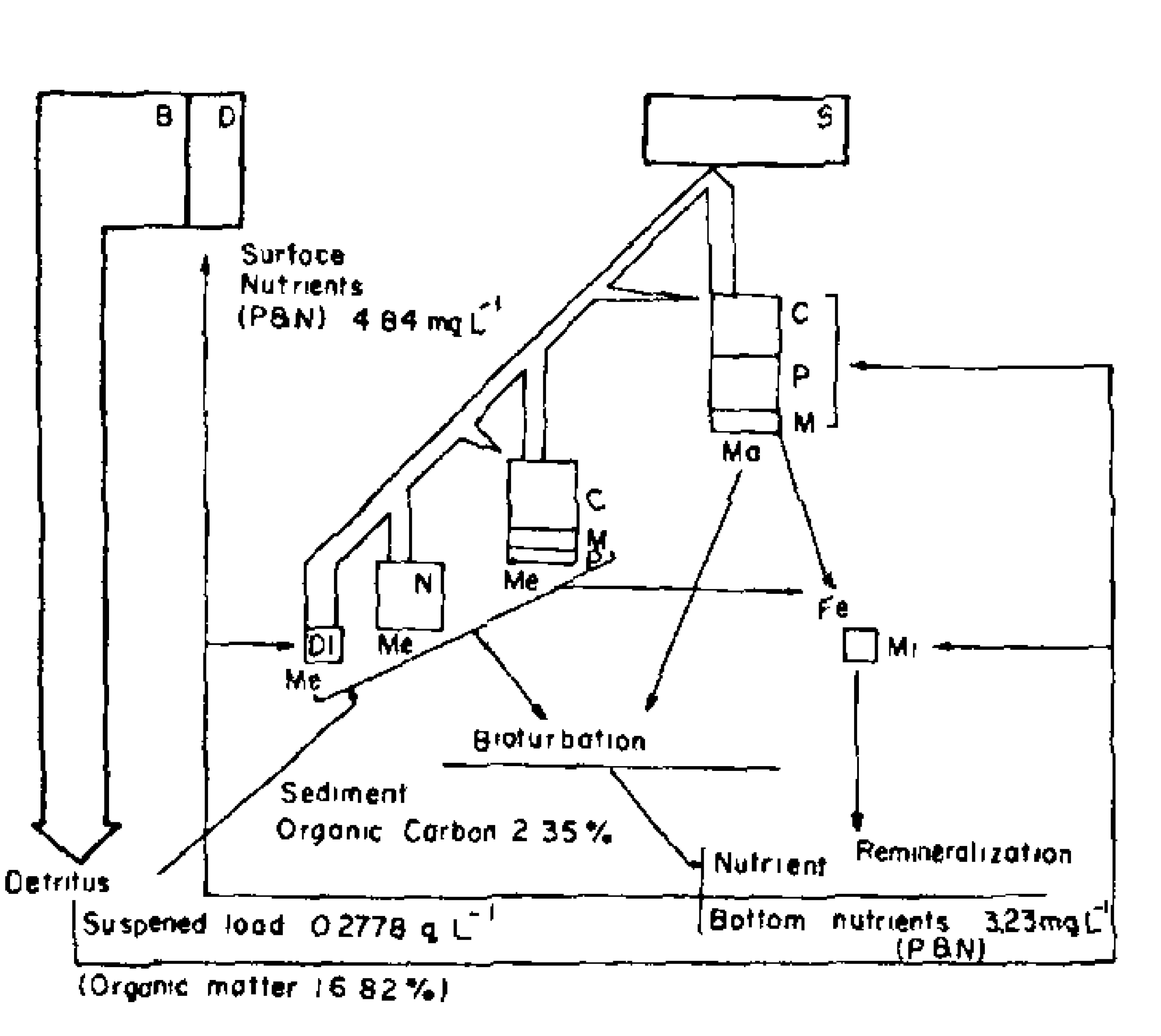

Figure 1. Diagram of food web leading to demersal production in Karwar waters. The relative proportions of biomass are indicated in the size of the boxes. All the data used for the figure are annual averages. Abbreviations used: B = Bacillariophyceae, D = Dinophyceae, S = Sciaenidae, Ma = Macrobenthos, Me = Meiobenthos, Mi = Microbenthos, Di = Diatom, N = Nematoda, C = Crustacea, P = Polychaeta, M = Mollusca and Fe = Fecal matter.

The benthic components as shown in figure 1 were mainly diatoms, nematodes (both meiobenthic), polychaetes, crustaceans and bivalves (both macro and meiobenthic). The nematodes (31.4 to 56.1% of the biomass of meiobenthos) and polychaetes (18.64 to 48.57% of the biomass of macrobenthos) dominated the benthic assemblage. A gross production of 0.56 to 11.31 mg C 10 $cm^{-2}yr^{-1}$ for meiobenthos and 9.90 to 274.3 mg C $m^{-2}yr^{-1}$ for macrobenthos were recorded. Some of the benthic species which dominated these waters were *Lumbrinereis* sp., *Glycera alba*, *Anticoma quadriseta*, *Ochetostoma* sp., *Katellsia opima*, *Penaeus indicus* and *Heteromastus* sp. The fluctuation of benthic biomass was similar to those of suspended load and organic carbon in the bottom waters and sediment respectively. This indicates that the detritus (allochthonous) and fecal matter which are the only sources of noncellular organic matter on the seabed have a large influence over the benthic heteroptrophs.

Demersal fin fish production in Karwar waters is dominated by the fishes of the group sciaenidae (25.2%) like *Otolithus ruber*, *O. cuvier*, *Johnius belangerii*, *J. dussumieri*, *J. glaucus*, *J. carutta*, *J. coitor*, *Johniops vogleri*, *Kathala axillaris*, *Nibea soldado*, *Pennahia macropthalmus* and *Dendrophysa russelli*. It is known from the studies on food and feeding habits of some sciaenids, especially *J. belangerii*[12] that the gut contents comprise of 47.4% of crustaceans, 15.1% of molluscs, 9.0% of polychaetes, 9.3% of echiurids and sipunculids most of which are benthic metazoans. Availability of *Ochetostoma* sp. in the gut has further confirmed the transfer of significant amount of energy into sciaenids by benthos feeding. The sciaenid production ranged from 7.1 to 25.6 tons yr^{-1} with an average annual production of 13.29 tons.

While these are the biological relationships of demersal production in Karwar waters, there are a few physical effects like hydrological changes and fishing effort which may also have some impact over the production. The model of relationships of demersal production can further be improved upon with a large scale multidisciplinary study.

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CLEOME PILOSA, BENTH., A C_3 PLANT WITH HIGH PHOTOSYNTHETIC EFFICIENCY AND SOLAR TRACKING ABILITY

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CLEOME PILOSA, Benth (Capparidaceae) a C_3 species is found to possess higher photosynthetic rates exceeding those of its C_4 counterpart, *Cleome gynandra*, L. The high photosynthetic rates observed in the C_3 pathway plant, *C. pilosa* are attributed to its ability to track the sun, the high stomatal conductance for carbon dioxide diffusion, high amounts of soluble leaf protein and of the enzyme RuBPCase. The photosynthetic characters of five species of the genus *Cleome* are compared in this report.

The seeds of *C. pilosa* were obtained as a gift from the Kew Botanical Gardens, London. Four other species studied of the same genus were *C. gynandra*, L, *C. viscosa*, L, *C. speciosa*, L and *C. Burmanni*, W & A. The seeds of these species were collected from different parts of India and all the plants were grown in the open garden of the University Campus, Tirupati, in the natural photoperiod and a temperature regime of 31°C by day and 23°C by night. Light intensity at the leaf surface was measured with a Li-Cor LI 170 lightmeter, CO_2 conductance was measured with an MKII porometer (Delta T devices). The photosynthetic rate was determined by $^{14}CO_2$ incorporation into acid stable products[1]. Activities of PEPCase and RuBPCase[2], CO_2 compensation point[3], the levels of soluble protein[4] and chlorophyll[5] were estimated. All the measurements were made on the fully expanded second or third leaf from the top of 6–8 week old plants and the values given are mean of five separate determinations on different dates.

Cleome pilosa has exhibited a striking diaheliotropism and its performance of photosynthesis was quite remarkable. At irradiances of 1400 $\mu E\,m^{-2}s^{-1}$ (400–700 nm) under normal atmospheric conditions at a leaf temperature of 28°C, *C. pilosa* fixed carbon at a rate of 59 mg CO_2 $dm^2 h^{-1}$. In contrast, the other *Cleome* species showed photosynthetic rates typical of their photosynthetic pathways (table 1). This observation has shown that *C. pilosa* has an exceptionally higher photosynthetic capacity exceeding that of the C_4 species of the same genus. Although there was not much variation in the CO_2 compensation point between *C. pilosa* and *C. speciosa*, the levels of RuBP