Interference of *Sigmadocia pumila*, a poriferan on the growth of red seaweeds, *Gelidiella acerosa* (Forsskal) Feldmann *et* Hamel and *Kappaphycus alvarezii* (Doty) Doty in cultivation

Seaweeds or marine macroalgae form a conspicuous biomass in the coastal regions of the tropics. They are the primary producers in aquatic habitats supporting rich food chains and they oxygenate the aquatic ecosystem[1]. Seaweeds can be found around the seashore in large amounts, clinging to solid substrates like corals, rocks or shells. Seaweeds interact with other marine organisms including animals which could be sessile or motile. Seaweed–animal interaction is possibly by the way of competition and grazing. Competition involves either scramble for a limiting resource, e.g. space, light and nutrients or without direct antagonism between the organisms[2]. Competitive interactions, particularly between plants and animals, have not been well documented and are poorly understood. The present study reports the unusual interference of *Sigmadocia pumila*, a poriferan member on growth of commercial seaweeds, viz. *Gelidiella acerosa* and *Kappaphycus alvarezii.*

G. acerosa, a warm-water, tropical, red seaweed is a significant source of biomass for agar extraction in many areas of the Pacific and Indian oceans[3–5]. The agar obtained from this seaweed has superior quality and is widely used in a number of preparations in biomedical, biotechnological, food, medicine, cosmetics and paper industries[6–8]. *K. alvarezii*, another economically important seaweed is a good source for carrageenan extraction. The carrageenan obtained from this seaweed is of *kappa*-type[9], and has high commercial value because of its potassium content. This has wide applications in food, medicine, cosmetics and agricultural industries. Because of fast growth rate and ease of vegetative reproduction, the cultivation of this alga has got worldwide attention.

Mariculture of *G. acerosa* and *K. alvarezii* is being carried out experimentally at the lower intertidal region at Ervadi (9°12′N, 78°44′E; Figure 1 *a*, *b*) adopting the raft method. Seedlings of *G. acerosa* and *K. alvarezii* were tied on a nylon thread and wound around the substratum in a raft made of bamboo poles. Small coral stones, coconut shells and polypropylene ropes were used as substrata for the attachment and growth of *G. acerosa*. The size of the raft was 1.5 × 1.5 sq. m. Growth data of both algae were recorded at weekly intervals to monitor their growth.

In February 2006, the sudden appearance of a thick, slimy mass with deep orange to red colour was noticed in our cultivation site. Its growth was at a peak in March 2006 and it was found inhabiting the surface of *G. acerosa* (Figures 2 *a* and 3 *a*) and *K. alvarezii* (Figure 2 *c*). Out of 39 rafts with *G. acerosa*, 29 were found infected with the red slimy mass. Around 60% of *G. acerosa* plants grown on coral stone (Figure 2 *a*) and coconut shell (Figure 2 *b*) and about 40% of *G.*

Figure 1. ***a***, Map of India showing beaching in Tamil Nadu. ***b***, Enlarged view of the Gulf of Mannar showing Ervadi, the cultivation site.

acerosa grown on rope were found covered with the slimy mass. Similarly, all the five rafts of *K. alvarezii* were found infected with this mass. Around 80% of plants was fully covered with the slimy mass. Infected plants of *K. alvarezii* started bleaching and degenerating, and resembled plants infected with ice-ice disease (Figure 2 *c*). Though the organism was non-motile, the intensity of its growth was rapid during the first three weeks. Due to this, further growth of *G. acerosa* and *K. alvarezii* in cultivation was badly affected, and most of the plants fell from the substratum that led to loss in crop yield. Further, the vigorous growth of this sessile organism on *G. acerosa* and *K. alvarezii* was found lowered at the end of April 2006, and completely disappeared during May 2006.

Some of this deposition were scrapped from the substratum with the help of knife using gloves. The scraped samples along with sea water were collected in plastic bottles and brought to the laboratory under live conditions. Few samples were preserved in 4% v/v formalin as well as in 100% methanol and 70% v/v alcohol. Samples were observed under microscope (model Olympus CH2, 5K). Photographs were taken using a Sony digital camera. Sea water temperature was recorded using standard centigrade thermometer (Amber). Salinity (Atago Refractometer) and pH (pHmeter DP 502) were also measured. Surface sea water samples were collected and PO_4-P, NO_3-N and NO_2-N were estimated using standard methods[10].

Observations using the microscope revealed that the slimy mass is a marine sponge, *Sigmadocia pumila* LendenFeld, belonging to the family Chalinidae, Porifera. It was further confirmed that the red coloured pigment was due to the presence of spicules (Figure 3 *b–d*), an important character of Porifera (sponges). *G. acerosa* infected with *S. pumila* showed stunted growth and pale brown colour (Figure 2 *d*), when compared to the uninfected healthy individuals which showed good growth and were dark brown in colour (Figure 2 *f*). Further, while handling the infected seaweed samples, there was itching in the hands. This may be due to some secretion from *S. pumila*, because marine sponges are reported to contain a rich source of diverse bacterial populations[11,12].

Physico-chemical analyses of sea water in the seaweed cultivation site showed an increase in nitrate content during February and March 2006 (Table 1). Further, the sea water in which live samples of *S. pumila* were kept emitted a pungent smell. There was an unusual increase in ammonium concentration (89.35 μg/l). The increase in ammonium and nitrate content was observed in the first three weeks, during the appearance of *S. pumila*, i.e. February to March 2006. By the end of April 2006, there was a decrease in the ammonium and nitrate content. The sudden appearance of *S. pumila* could be the reason for the increase in content of ammonium and nitrate in sea water.

In the present study, it has been observed that there was a sudden appearance of *S. pumila* in large quantities

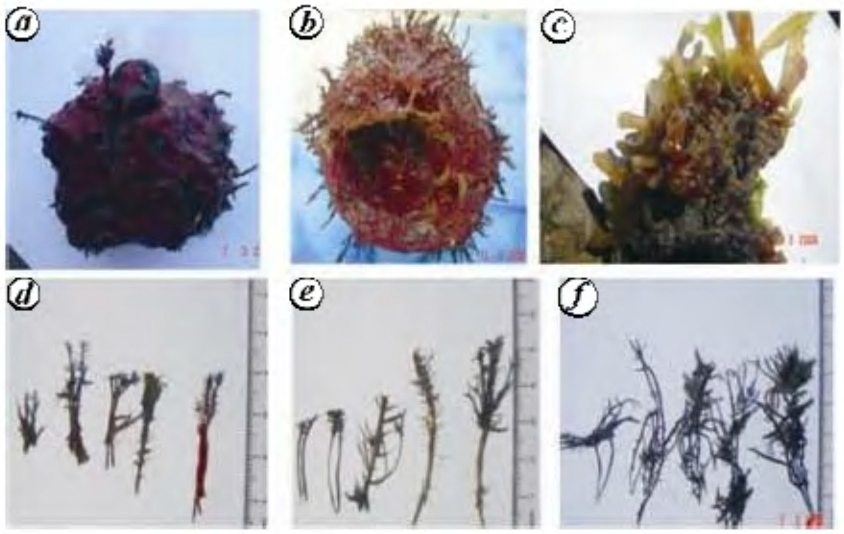

Figure 2. *Sigmadocia pumila*-covered plants of *Gelidiela acerossa* growing on coral stone (***a***) and coconut shell (***b***). ***c***, *Kappaphycus alvarezii* infected by *S. pumila*. ***d***, *S. pumila* growing on *G. acerosa*. ***e***, Thallus of *G. acerosa* showing pale brown colour. ***f***, Healthy thallus of *G. acerosa*.

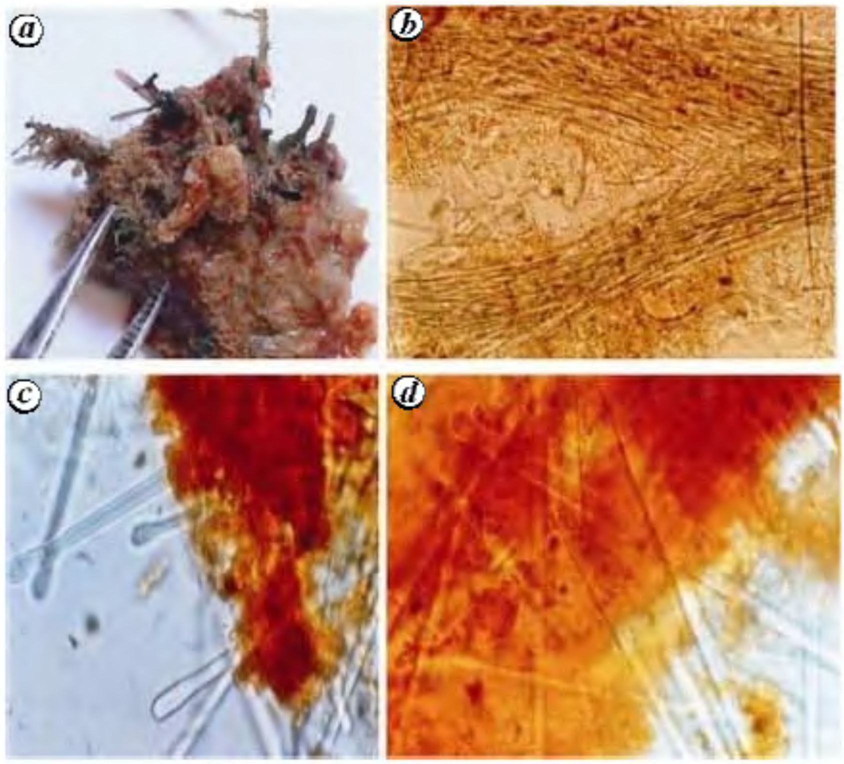

Figure 3. ***a***, *G. acerosa*-covered with *S. pumila*. ***b–d***, Spicules of *S. pumila* in different magnifications: ***b***, 40×; ***c***,10× and ***d***, 20×.

Table 1. Physico-chemical parameters of sea water collected from seaweeds cultivated site at Ervadi

Month	pH	Salinity (ppt)	Dissolved oxygen (ml/l)	Phosphate (μg/l)	Nitrate (μg/l)	Nitrite (μg/l)	Temperature (°C)	
							Air	Water
October 2005	8.03	32	1.48	1.54	0.16	0.21	24	27
November 2005	8.01	32	1.48	1.81	0.21	0.37	25	24
December 2005	8.10	27	2.28	0.81	0.04	0.23	27	28
January 2006	7.80	29	1.03	1.30	0.10	0.38	33	29
February 2006	7.92	27	3.84	–0.24	1.82	0.17	33	32
March 2006	8.10	28	1.00	1.27	1.50	0.13	31	28
April 2006	7.90	28	1.02	1.48	0.90	0.2	32	28

followed by a complete decay, indicating its short life span. Temporary loss of *G. acerosa* or *K. alvarezii* crops could be either because of their competitive interaction with *S. pumila* for space, light and nutrients and/or due to some chemical exudates from *S. pumila*. Future study needs greater focus on the chemical, functional and behavioural aspects of the seaweeds and sponges that infect them.

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Rutaleyrodes atalantiae, a new genus and species (Hemiptera: Aleyrodidae) from India

The family Aleyrodidae (whiteflies) includes small inconspicuous phytophagous bugs often overlooked on the lower surface of leaves. They rank among the least studied group despite their importance as pests of agricultural, horticultural and forestry crop plants and their potential to transmit plant disease-causing viruses. The whitefly taxonomy is exclusively based on the fourth nymphal instar (so-called 'pupal case'), and use of puparia rather than adults for identification is well discussed by Martin[1]. The whitefly subfamily Aleyrodinae is represented in India by 57 genera, with majority of them from the Western Ghats. While studying the whiteflies of these ghats, *Rutaleyrodes* gen. nov. is described to accommodate a new species that differs from *Aleurolobus* Quaintance & Baker in the absence of a submarginal furrow, deeply invaginated thoracic tracheal combs giving it a pouch-like appearance and in the presence of tubercles on it; open type of vasiform orifice, and merging place of vasiform orifice and caudal furrow with inwardly directed lateral projections.

Rutaleyrodes Dubey and Ko gen. nov.

Type species: *Rutaleyrodes atalantiae* Dubey and Ko, sp. nov.

Diagnosis: Puparia black with waxy secretion. Margin crenulate; submarginal area not separated from dorsum by suture. Eye-spots present. Thoracic and caudal tracheal combs present. Thoracic tracheal furrows tuberculate, pouch-like. Cephalic, first abdominal, eighth abdominal and caudal setae present. A row of submarginal setae present. Longitudinal molting suture reaching margin; transverse molting suture reaching near thoracic tracheal furrows on submarginal area. Tubercles present throughout dorsum, rhachises in continuation of segment sutures. Vasiform orifice trilobed, open-type, posterior end with inwardly directed lateral projections; operculum subtriangular, lingula concealed. Tracheal folds not indicated. Stipples present.