JOURNAL OF PURE AND APPLIED MICROBIOLOGY, April 2007. Vol. **1**(1), p. 127-129

Antibacterial Activity of *Spirulina platensis* and *Oscillatoria* Sp.

S. Kulandaivel*, R. Prakash, R. Anitha and N. Arunnagendran

Post graduate and Research unit of Microbiology, Thiagarajar College, Madurai – 625 009, Tamil Nadu, India.

(Received: 06 February 2007; accepted: 15 March 2007)

In the present investigation an attempt has been made to experimentally test the antimicrobial efficacy of Blue green algae, *Spirulina* and *Oscillatoria* against various pathogens both the algae were tested separately using different solvent such as acetone, ethanol and diethyl ether for the extraction of active compounds. Among these diethylether extract was found to be high effective against *E. coli*, *Pseudomonas* sp., *Klebsiella pneumonia*, *Enterobacter* sp. and *Salmonella typhi*. In rest of the solvents extracts exhibited varying degree of inhibitory activity.

Key words: *Spirulina platensis*, *Oscillatoria*, Solvents, antimicrobial activity.

The Cyanobacteria are an ancient and diverse group of photosynthetic microorganisms. Blue green algae (Cyanobacteria) dating back almost 3.5 billion years and become one of the most successful and economically significant group (Kumar *et al.,* 2003). Algae are rich in proteins, essential aminoacids, vitamins and natural β-carotene and minerals such zinc, selenium and magnesium. Edible blue green algae like *Spirulina* and *Aphanizomenon* and *Nostoc* are being used as food.

Cyanobacteria have yielded new types of products, not found in higher plants and traditional drugs sources (Shimizu, 1996). β-carotene is also proven to stimulate the immune system (Kazi *et al.,* 1997) and prevent skin cancer (Santamaria, 1996) oral and breast cancer (Garewal, 1995). BGA serves as a protein storage unit and as an antioxidant and inflammatory agent (Romay, 1998). The present study aims was to analyse the antibacterial activity of *Spirulina* sp. and *Oscillatoria* sp. against bacterial pathogens.

* To whom all correspondence should be addressed.
E-mail: microskv@yahoo.com

MATERIALS AND METHODS

The culture of *Spirulina plantensis* and *Oscillatoria* sp. was obtained from the Department of Botany, Thiagarajar College, Madurai. The two cultures were subcultured in Zarrowk's medium and Chu's – 10 medium.

The pure form of *Spirulina platensis* and *Oscillatoria* sp. were grown in both synthetic medium and dairy effluent. Then, they were incubated at room temperature for 10 days and analysed the antibacterial activity.

Preparation of antibacterial compounds

Crude extracts of the cyanobacteria were prepared using different solvents *viz.* acetone, ethanol and diethyl ether (Rao, 1986).

10gm of each dried algal powered sample were ground with 50ml of diethyl ether, 50ml of acetone, 50ml of ethanol separately. Then they were centrifuged at 1000rpm for 15min. The respective supernatants were transferred separately into sterile screw cap test tubes and stored at room temperature.

Antibiotic disc preparation

Antibacterial activity of the cyanobacterial

extracts were evaluated against different bacterial cultures. The experiment was performed by following Kirby-Bauer disc diffusion method. Sterilized discs were made from Whatmann no. 1 filter paper (5mm diameter) and 50 µl of extracts were loaded to the discs and dried completely in sterile condition (Padmini Sreenivasa Rao *et al.,*1986).

Antibacterial Assay

The prepared *Spirulina plantensis* and *Oscillatoria* sp. extracts were screened for antibacterial activity against six pathogenic bacteria *E. coli, S. typhi, Pseudomonas* sp., *V. cholerae, K. pneunoniae* and *Enterobacter* sp. Sterile Muller Hinton agar plates were prepared and the inoculum (18-24hrs old culture) of the pathogenic bacteria were spread by using sterile swabs. The crude extract loaded discs were placed on the seeded plates by using a sterile forceps. The plates were then incubated for 24-48 hrs and observed for clear zone of inhibition. The inhibition zone was measured in mm.

RESULTS AND DISCUSSION

The antibacterial compounds were extracted from Cyanobacteria using different solvents *Viz.* acetone, ethanol and diethyl ether. The extracts were tested against *E. coli*, *K. pneumoniae, Pseudomonas* sp., *V. cholera, S. typhimurium* and *Enterobacter* sp. (Table 1). The diethyl ether extracts of *Oscillatoria* and *Spirullina* are sensitive to *E. coli*, *Pseudomonas* sp., *K. pneumoniae, Enterobacter* sp and *S. typhi.* The ethanol extract of *Oscillatoria and Spirulina* show moderate sensitive to *E. coli*, *K. pneumoniae* and, *Enterobacter* sp. except *Enterobacter* sp. and *K. pneumoniae,* all other bacteria resistant to acetone extract compound.

Shrivastava *et al.,* (2001) have isolated and characterized an active compound called *Oscillatorin* from *Oscillatoria laetevirens.* It exhibits a minimum inhibition on other cyanobacteria and an interesting herbicidal activity. The cell extracts of *Lyngbya* was most effective against *Xanthomonas vesicatoria.*

The water soluble extract of *Spirulina platensis* was found to have a sulphated polysaccharide, Calcium spirulinan. Which is an antiviral agent (Hayashi and Hayashi, 1996). These compounds selectively inhibits the penetration of enveloped viruses (Herpes simplex, Measles virus, Mumps virus, Influenza A virus, and HIV I) into host cell. *Spirulina* is widely used as biotherapeutic agent against oral cancer, *Diabetes mellitus* (Mani *et al.,* 2000). Cholesterol lowering effect (Nakaya and Honma, 1988). Intestinal and vaginal infections (Elmer *et al.,* 1996). Therefore, *Oscillatoria* sp. and *S. platensis* could be used in food industry. In pharmaceutical industries, it is in therapeutic use as an alternative medicine and also colouring agent.

Table. 1. Antibacterial activity of *Spirulina plantensis* and *Oscillatoria* sp. against various pathogenic bacteria

Organism	Sample	Ethanol extract (mm)	Acetone extract (mm)	Diethyl ether extract (mm)
E. coli	*Oscillatoria* sp.	11	-	13
	S. platensis	20	-	12
Pseudomonas sp.	*Oscillatoria* sp.	-	-	10
	S. platensis	-	-	20
V. cholerae	*Oscillatoria* sp.	-	-	-
	S. platensis	-	-	-
S. typhi	*Oscillatoria* sp.	-	-	9
	S. platensis	-	-	7
K. Pneumoniae	*Oscillatoria* sp.	13	9	7
	S. platensis	11	10	14
Enterobacter sp.	*Oscillatoria* sp.	13	10	14
	S. platensis	15	13	7

REFERENCES

1. Elmer, G.W., C.M. Surawicz and Mc Farland: Biotherapeutic agents: A neglected modality for the treatment and prevention of selected intestinal and vaginal infections, *JAMA*. 1996; **275:** 870 – 876.
2. Garewal, H.S. Emerging role of beta-carotene and antioxidant nutrients in prevention of oral cancer. *Arch. Of Otolaryngology.* 1995; **121:** 141 – 144.
3. Hayashi, K., and T. Hayashi: A natural sulfated polysaccharide, Calcium – spirulinan isolated from *Spirulina platensis*: *invivo* and *exviva* evaluation of anti-herpes simplex virus and anti-human immunodeficiency virus activities. *Aids. Res. Hum. Retrovir.* 1996; **12:** 1463 – 1471.
4. Kazi, N., R. Radvany, T. Oldham, A. Keshavarizion, T.O. Frommel, C. libertine and S. mobarhan: Immunomodulatory effect of Carotene on T-lymphocyte subsets in patients with resected clonic polyps and cancer. *Nutr. And Can.* 1997; **28**(2):140 – 145.
5. Kumar, K., A. Lakshmanan and S. Kannaiyan: Bioregulatory and Therapeutic effects of blue green algae. *In. J. Microbiology.* 2003; **43:** 9-16.
6. Mani, U.V., S. Sangeeta, U.M. Iyer, S.R. Subramanian: Studies on the effect of *Spirulina* supplementation in control of diabetic mellitus. In Cyanobacterial biotechnology (Subramanian, G., Kaushik, B.D., and Venkataraman, G.S *eds.*) *oxford and IBH publishing company,* New Delhi. 2000; 301-309.
7. Nakaya, N. and Y. Honma: Cholesteral lowering effect of *Spirulina. Nutr. Int.* 1988; **37:**1329-1337.
8. Padmini sreenivasa Rao, P., P. Sreenivasa Rao and S.M. Karmarkar: Antibacterial Substances from brown algae 11. Efficiency of solvents in the evaluation of antibacterial substances from *Sargassum johnstonii*. *Bot. Mar.* 1986; **29:** 503 – 507.
9. Rahul Shrivastava., Soma Ray and Suvendra N. bagchi: Action of an algicide from a cyanobacterium, *Oscillatoria laetevirens,* on photosystem II. *Indian J. Exper. Biol.* 2001; **39:** 1268 – 1273
10. Romay, C., N. Ledon and R. Gonzalez: Phycocyanin extract reduces Leukotriena B4 levels in arachidonic acid induced mouse – ear inflammation test. *J. Pharm. Pharmacol.* 1999; **51:** 641 – 642
11. Santamaria, L., A. Bianchi, A. Amaboldi, C Ravetto, L. Bianchi; R. Pizzala, L. Andreoni, G. Santagati and P. Bermond: Chemoprevention of indirect and direct chemical carcinogenesis by carotenoids as oxygen radical quenchers. *Ann. New York Acad. Ki.* 1996; 584-596**.**
12. Shimizu, Y.: Microalgal metabolites: A new perspective *Annu. Rev. Microbiology.* 1996; **50:** 431 – 465.