CIBA NEWS

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CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE, MADRAS

VIRAL EPIZOOTICS IN SHRIMP

This is a general article on viral diseases of shrimps which have affected the aquaculture industry of India during the last two years. Research on the viral diseases of aquatic organisms under culture are recent and have been largely concerned with the development of diagnostic techniques. More recently, work on DNA probes for rapid diagnosis has received attention. As of now, reliable control measures against viral diseases of shrimp are not available. Prevention through healthy and hygeinic management practices can help reduce losses. This article aims at informing shrimp farmers/industry for gaining an understanding into the problem.

The Indian shrimp culture industry is in a state of depression within about three years of riding the crest of a boom wave. On the one hand, it confronted alleged socio-economic and environmental degradation issues in certain areas of concentration of shrimp farms and, on the other, shrimp disease epizootics have caused significant production and economic losses. In 1994-95, loss of shrimp production due to diseases was estimated between 10,000 and 12,000 tonnes. The trend has continued through 1995-96. These problems were not unexpected as we had numerous examples of similar situations in Taiwan, the Philippines, Thailand and China, as also in Ecuador. The alleged social and environmental issues could be resolved by promoting people's participatory programmes and strict implementation of the existing guidelines and legal framework of the country. The other major issue of viral disease epizootics in shrimp farms may be contained with a deep understanding of the promblems involved. The aim of this article is to educate and increase the understanding of the farmers in dealing with the major viral diseases. It would also deal with known preventive measures which will be of help to the farmers.

What are viruses and how do they cause disease ?

Viruses are particles whcih can be seen only under high power electron mocroscope. Among those known to effect shrimps, the smallest one measures about 22nm (one nm is one millionth of a millimeter) and the largest are baculoviruses, measuring 75- 300nm. Viruses are made up of nucleic acid, either the deoxyribonucleic acid (DNA) or ribonucleic acid (RNA), which is enclosed by a protein coat. The protein coat is host-specific and aids in the process of infection. The virus attaches to specific site on the host cell and injects its nucleic acid into the cell.

Upon entry of viral nucleic acid into the cell, the DNA of the host cell is broken down

Important viral diseases of penaeid shrimps known in the world

Sl.	Virus	Hosts	Effect on the stock	Geographic area
1.	Systemic ectodermal and mesodermal baculovirus (SEMBV)	*P. monodon* *P. indicus* *P. japonicus* *P. chinensis* *P. merguiensis* *P. vannamei*	All sizes affected; 100% mortality within 3-5 days.	China, India, Japan, Thailand.
2.	Monodon-type baculovirus (MBV)	*P. monodon* *P. indicus* *P. esculentus* *P. semisulcatus* *P. merguiensis* *P. penicellatus* *P. kerathurus* *P. plebejus*	Low level mortalities; often due to secondary bacterial infections.	Taiwan, Indonesia, Australia, India.
3.	Yellow head baculovirus (YBV)	*P. monodon*	Above 5g affected; 100% mortality within 3-7 days.	Thailand, Taiwan.
4.	Infectious hypodermal hematopoietic necrosis virus (IHHNV)	*P. vannamei* *P. stylirostris* *P. monodon* *P. semisulcatus*	High mortality rate.	Hawali, Panama, Costa Rica, Ecuador, Tahiti, Singapore, Israel, Taiwan, France, Peru.
5.	Baculovirus penaei (BP)	*P. duorarum* *P. aztecus* *P. vannamei* *P. marginatus*	Acute epizootics in larval stages 100% mortality in 24-48 h.	Hawali, Florida, Texas, Missisippi.
6.	Baculoviral mid gut gland necrosis (BMN) virus	*P. japonicus*	Serious epizootic in hatcheries upto 98% cumulative mortality.	Japan.
7.	Hepatopancreatic parvo-like virus (HPV)	*P. merguiensis* *P. semisulcatus* *P. chinensis* *P. esculentus*	Poor growth rate; 50-100% mortality in 4-8 weeks of onset.	Southeast Asia, China, Australia, Persian Gulf.
8.	Lymphoid organ parvo-like virus (LOPV)	*P. monodon* *P. merguiensis* *P. esculentus*	Not known.	Australia.
9.	Reo-like virus (REO)	*P. monodon* *P. japonicus* *P. vannamei* *P. chinensis*	REO infections often occur along with other pathogens.	France, Hawaii, China.
10.	Taura Syndrome Virus (TSV)	*P. vannamei*	Heavy mortality during 15-40 days culture period.	Ecuador.

Type of virus : S.No. 1,2,3,5 and 6 - Baculovirus; S.No. 4,7 and 8 - Parvo-like virus; S.No. 9 - Reo virus; S.No. 10 - Nodavirus.

into small subunits and these are utilized for synthesis of the viral nucleic acid. Thus, the viral nucleic acid is replicated many times. Viral DNA also directs the cell (through messenger RNA) to synthesize proteins that are required for its coat. Thus, the complete viruses are produced using newly formed copies of viral nucleic acid will be released outside upon rupture of the cell which can infect fresh healthy cells to continue the cycle. Viruses by themselves cannot grow or multiply as bacteria or other living organisms do.

Upon entry into the host cell, the viruses bring about several changes within the cell. Various abnormal granules can be observed within virus infected cells. These inclusions may be aggregates of viruses or modified cellular components. The types of these inclusions and their loaction within the cell are characteristic to each viruses.

The viruses thus destroy the cells of different tissues. Consequently, the functions of the organs of shrimp are affected leading to disease and its symptoms. The spread of virus infection is so fast that in the case of yellow head or the white spot, virus infections (about 3-4 days).

How viral diseases spread in the shrimps?

Small crustaceans and other aquatic organisms may carry shrimp pathogenic viruses and if these enter culture ponds can cause infections in healthy shrimp. Healthy shrimps may be affected by feeding on infected dead aquatic animals or cannibalism on infected moribund animals. Viral diseases in grow-out ponds may also be transmitted through birds, which may pick up infected and dead shrimps and drop them in uninfected ponds. Infection may also take place when the shrimps injest pathogenic viruses present in the contaminated rearing water. The viruses may gain entry into the shrimps through abrasions, wounds or injuries on the body. Once inside the body cavity of shrimp, the viruses may be carried to their target organs through haemolymph.

Recent viral disease outbreaks in Indian Shrimp farm

The epizootics affecting the shrimp farms in most of the maritime states of our country during the past two years have been caused by viruses, notably, the yellow head-like virus and the systemic ectodermal and mesodermal baculovirus (white spot disease).

Yellow head(YHD)-like disease

The first major epizootic of cultured shrimps in India was recorded during July to September 1994 in the shrimp farms along the Kandaleru creek area in Nellore district of Andhra Pradesh. The epizootic tiger shrimp, Penaeus monodon was affected by the disease. Mass mortality of shrimp was attributed to primary viral infection followed by secondary bacterial infection. Shrimps were lost within 3-5 days of initial mortality. It was not possible for the farmers to detect the onset of disease since the affected shrimps did not exhibit any symptoms. Although pattern of disease and mortality were similar to the yellow head disease reported from Thailand, the Kandaleru disease markedly differed from YHD in histopathology.

White spot disease

White spot disease, scientifically known as systemic ectodermal and mesodermal baculovirus (SEMBV) has been the major cause of large scale mortalities of cultured shrimps in India. The disease was first reported soon after the onset of Northeast monsoon in November 1994 from some shrimp farms in Nellore area. Since then, this disease has ravaged shrimp farms in almost all the maritime states of our country and has been responsible for bringing down shrimp production from the culture sector. Unlike the YHD, whcih affects only P. monodon, this disease affects both tiger and white shrimps

of all sizes. In the initial phase of this epizootic from November 1994 to July 1995, whole shrimp stock was lost within 3- 5 days time in the affected farms. Of late, the virulence of the pathogen seems to have been reduced to some extent with cent percent mortality occurring over a period of 10-15 days in the farms affected with this epizootic. It has been reported that in a few cases, crops were taken even with whitespot disease. Initially, minute white spots develop on the cephalothorax and tail. Subsequently they spread all over the exoskeleton and the white spots enlarge to patches of 2-3 mm size. Reddish colouration of body and appendages has also been noticed in many specimens. Histo-pathological examination revealed extensive damage and presence of viral inclusions in the cuticular epidermis, gills, lymphoid organs and gut wall.

Monodon-type baculovirus (MBV)

The monodon-type baculovirus (MBV) has been prevalent in shrimp farms and hatcheries since 1993. The tiger shrimps can withstand MBV infections so long as the pond environmental conditions are good. MBV infected shrimps may acquire secondary bacterial infections and may succumb to the disease. Mortalities may be high when the environmental conditions are hostile. CIBA's study has shown that P.indicus which was so far thought to be resistant to MBV infection, has also been affected by this baculovirus.

How do we diagnose viral diseases in shrimps ?

The simplest and highly useful method of viral disease diagnosis is microscopic examination of wet-mount preparations of tissues such as hepatopancreas and even faeces of shrimps stained with vital stains. This is useful in presumptive diagnosis of certain viral infections such as monodon-type baculovirus (MBV) and baculovirus penaei (BP). However, microscopic examination of pathological and cellular changes in the target tissues is a more dependable technique. This involves elaborate procedures of appropriate fixing, sectioning, and differential staining, which is time consuming and laborious.

Electron microscopic identification of viruses in ultre-thin sections of tissues is used for confirmatory diagnosis of viral infections. This requires expensive equipment and expertise.

Rapid diagnostic techniques

Shrimp disease diagnosticians are exploring the possibilities of employing the methods developed in the fields of modern molecular biology and immunology. The immuno diagnostic tests are primarily based on the reactions between the antigen (pathogenic microorganism such as virus or bacteria) and the antibodies (the reactive proteins produced in the animal upon entry of antigen into the body). The antigen-antibody reactions are highly specific. These tests are very useful and usually takes about 4 to 6 hours. The enzyme linked immunosorbent assays (ELISA) have been developed for detecting infections of *Vibrio* bacteria and baculovirus in shrimps by some workers. But these tests have not been commercialised as yet. Progress has been made for developing dot immuno assay and fluorescent antibody test (FAT) for diagnosing viral and bacterial infections in shrimps.

The most recent among the diagnostic techniques are the DNA based diagnostic tools for certain viral diseases of shrimps. DNA probes have been commercialised for diagnosis of monodon-type baculovirus (MBV) and infectious hypodermal and hematopoietic necrosis virus (IHHNV). These probes are unique and have specific sequences of DNA to the respective pathogens. These diagnostic kits are based on *in situ* hybridisation and dot blot hybridisation assays using the probe. The former requires 2-3 days and the latter about 5-7 hours.

In addition to the above, the polymerase chain reaction (PCR) is a very recent entry among the diagnostic techniques. This test is highly sensitive and detects very low quantities of DNA of the micro-organism and is useful in detecting infections in very early stage. This test has been developed for detection of MBV infections in shrimps but not yet commercialised.

Are 'cures' available against viral diseases?

Attempts to control viral disease in poultry, animals, humans and plants by chemotherapy have achieved limited success. Approach to control the viral diseases in these organisms through prophylactic vaccines has yielded promising results against important diseases such as small pox, polio and rabies in humans, foot and mouth disease, rabies, rinder pest, canine distemper etc. in animals, and fowl pox, new castle disease, etc. in poultry. This success has been mainly attributed to the extensive research carried out over a period of several decades on these pathogens and the immune systems of the hosts. It can be recalled here that the dedicated research over the past 15 years in many laboratories around the globe is yet to yield prophylactic and control measures against the dreaded human immuno-deficiency virus (HIV).

Investigations on the shrimp diseases have been taken up in several laboratories around the world since only about a decade ago and these studies have been found to be useful in diagnosis of viral diseases and characterising some viruses. The initial works on the defence system have indicated that unlike the higher animals, the shrimps do not possess a well defined and developed immune system and that, their immune system markedly differs from that of the higher animals. Hence, it may not be possible at this stage to adapt the prophylactic technologies developed for higher animals in shrimp aquaculture. Till prophylactic and control measures are developed based on scientific understanding of the pathogens and the shrimp immune system, avoidence appears to be the only means of combatting viral diseases in the shrimp farms.

GENERAL GUIDELINES

1. Dry the ponds and plough. Fill about 10 - 15 cm of water and wait for 3 days to allow encysted organisms to hatch. Disinfect by chlorination @ 10 - 15 ppm of chlorine using appropriate quantities of commercially available bleaching powder (calcium hypochlorite). Allow for three days before application of fertilisers and manures.

2. Provide two reservoir ponds in the farm. In the first pond, allow sedimentation of suspended matter. Disinfect by applying 10 - 20 ppm chlorine and mix the pond water using adequate number of paddle wheel aerators. Allow the chlorine to act for 12 - 24 hours. Pump the disinfected water into the second reservoir pond and aerate vigorously using about 6 paddle wheel aerators per ha, to remove residual chlorine. Allow the water to remain in the second reservoir pond for about a day before using for culture activity.

3. Stock only healthy postlarvae in the ponds. Nursery rearing will be useful to eliminate weaker larvae.

4. Decide stocking density in a farm based on the number of shrimp farms in the area, quantity and quality of salinewater available.

5. Use screens of proper mesh size at water inlet to avoid entry of small crustaceans, wild shrimps, crabs and other aquatic organisms which are likely to carry shrimp pathogenic viruses.

6. Maintain optimum phytoplankton bloom (light green colour) and transparency (sec-

chi disc depth of 40 - 60 cm) in the pond during the culture period.

7. Make routine observations on the health of shrimps. Keep vigil on the swimming behaviour of shrimps. Examine shrimps for any signs and symptoms that are externally visible. Take help from experts on shrimp health whenever abnormal conditions are noticed.

8. Observe a good feeding programme using balanced feeds. Watch feeding behaviour of shrimps regularly. Fluctuations in the rates of feed consumption is an indication of bad health of shrimp.

9. Avoid water exchange whenever an epizootic is noticed in the neighbouring farms.

10. Destroy diseased/dead shrimps either by burning or by burying with lime away from the farms.

11. Provide a pond to allow treatment of farm effluents by settlement and disinfection prior to discharge into natural water bodies.

12. Do not release diseased/dead shrimps and water from affected ponds into natural water bodies. Hold and disinfect such water with chlorine before discharge.

13. Do not use the same equipment in all the ponds. Do not wash the equipment in the inlet water canal. Wash the farm implements after every use with detergent and dry.

This article was prepared by the following scientists of the Institute, Shri S. V. Alavandi, Dr. K. K. Vijayan, Dr. K. V. Rajendran, Shri M. S. Shashi Sekar, Dr. S. S. Mishra and Dr. T. C. Santiago.

R & D HIGHLIGHTS DURING 1995 - 96

Development of broodstock of tiger shrimp

To reduce the dependence on wild gravid females of tiger shrimp (*P. monodon*) for hatchery operations, 600 pond-grown specimens with an average size of 33 g were reared on a diet of CIBA pelletised feed and cooked clam meat in a 0.075 ha pond at Muttukadu Field Centre of the Institute. The shrimps have reached an average size of 77 g for males and 93 g for females in 6-month rearing and they were transferred to laboratory tanks for induced maturation trials. Female shrimps subjected to unilateral eye-stalk ablation have successfully matured in 27 days and gave viable spawnings.

Broodstock holding facility for seabass and mullet

Captive broodstock of seabass *(Lates calcarifer)* and grey mullet *(Mugil cephalus)* reared in confined earthern ponds were transferred to 100 ton capacity RCC tanks with flow- through seatwater system. For the first time in the country, a modern facility has been created by CIBA at Muttukadu for rearing fish broodstock under captive condition.

Shrimp disease investigation

Microbiological and histopathological studies conducted on the diseased tiger and white shrimps obtained from the shrimp farms from Orissa, Andhra Pradesh, Tamil Nadu and Kerala have shown that the white spot disease, also known as SEMBV (Systemic Ectodermal and Mesodermal Baculovirus) disease was the major cause for large-scale mortalities. The Monodon Baculovirus (MBV) disease was also found in the samples of shrimps from the culture ponds and the larvae from the hatcheries.

Fish broodstock holding facility at Muttukadu

CIBA shrimp feed testing

The shrimp feed developed by the Institute was tested in a farmer's field at Ongole, Andhra Pradesh. The tiger shrimp seeds stocked at a rate of 67,500/ha in a 0.4 ha pond were fed with CIBA feed and they have attained an average size of 22 g in 113 days.

VISITORS

Madras

Dr. R.S. Paroda, Director General, ICAR, 3rd March and 7th August, 1995.

Shri. T.S. Krishnamurthy, Additional Secretary (Expenditure), Ministry of Finance, Govt. of India, 22 June.

Shri. N. Parthasarathy, Joint Secretary, Govt. of India and Advisor, DARE, New Delhi, 5 September.

Dr. Harman Van Wersch, Principal Operation Officer, Dr. Ronald Zweig, Aquaculturist and S.P. Agarwal, Senior Finance Officer from the World Bank team for Mid-term Review on Shrimp and Fish Culture Project, 15 November.

Dr. T.V.R. Pillay, Former FAO Aquaculture Consultant, Dr. R. Natarajan, Rtd. Professor, Centre of Advanced Study in Marine Biology, Parangipettai and Dr. H.P.C. Shetty, Rtd. Professor, Fisheries College, Mangalore, 23-24 February' 96.

Dr. T.J. Varghese, Rtd. Professor, Fisheries College, Mangalore, 7-9 September 95 & 18-19 March 96.

ENGAGEMENTS

Dr. K. Alagarswami, Director attended the following meetings/workshops/seminars/field visits.

Conference on Informatics for sustainable agriculture development at New Delhi, 23-25 May 95.

National Workshop on poultry, fisheries and food proccessing in India at NAARM, Hyderabad, 4-5 July.

First meeting of the Technical Committee for reviewing incidence and causes of shrimp diseases and the issues arising out of the Hon'ble Supreme Court injunction on the basis of NEERI report at Dept. of Agriculture and Co-operation, Ministry of Agriculture, New Delhi, 5-7 July.

Extension Council of CIFE, Mumbai, 20-21 July.

Meeting convened by the Secretary, Forest and Environment, Govt. of Tamil Nadu, Madras, 24 July.

Bay of Bengal Project on Coastal Fisheries Management, Madras, 28-29 August.

Interaction meeting on aquaculture feed development, Dept. of Biotechnology, New Delhi, 12-13 October.

20th meeting of Central Board of Fisheries, Calcutta, 3rd November.

First meeting of the Patents Registration Committee, Calcutta, 4th November.

Visited the shrimp farms located in Prakasam and Krishna Districts and the World Bank Shrimp Culture Project site at P.T. Palem, Andhra Pradesh, 21-25 November.

Meeting with the World Bank Review Mission for establishment of a Centre of Excellance on Shrimp Disease Monitoring and Diagnostics, New Delhi, 27-28 November.

Meeting with the Solicitor General of India regarding the case on environmental consequences of shrimp farming under hearing before the Hon'ble Supreme Court of India, New Delhi 30 November to 2 December and 10-13 December.

Visited the World Bank assisted shrimp farming site at Bhairavapalem, Andhra Pradesh, 25-27 December.

Meeting with the Director of Fisheries and the Secretary (Fisheries), Govt. of Andhra Pradesh, Hyderabad, 28 December.

Expert Committee of TANUVAS, Fisheries College and Research Institute, Tuticorin, 9-11 February 96.

Meeting of the Working Group of Fisheries for Ninth Five Year Plan, New Delhi, 19-20 February.

ICAR Directors' conference, New Delhi, 26-29 February.

Seminar-cum-Exposition on aquaculture organised by Madras Chengalpattu Aqua Farmers Association, Madras, 17 March.

Seventy seventh meeting of MPEDA, Kochi, 20-22 March 96.

Dr. R.D. Prasadam, Principal Scientist discussed with the Commissioner of Fisheries, Govt. of Maharashtra regarding the formation of an All India Co-ordinated Project on Sustainable Shrimp Farming, Mumbai, 20-23 April 95.

Dr. C.P. Rangaswamy, Dr. B.P. Gupta and Dr. S.S. Mishra, Scientists surveyed the shrimp farms affected with disease problems in Balasore and Bhadrak Districts of Orissa, 23 - 29 April.

Dr. M. Krishnan, Scientist (SS) attended a meeting of the Project on Agricultural Ressearch and Information Service (ARIS) at Indian Institute of Horticulture Research, Bangalore, 4 May.

Dr. K.V. Ramakrishna, Principal Scientist attended the National Workshop on Poultry,

Fisheries and Food Proccessing in India, NAARM, Hyderabad, 4-5 July.

Dr. B.P. Gupta and Dr. K.K. Vijayan, Scientists surveyed the shrimp farms affected with disease problems in Kakinada, Amalapuram, Narasapur and Machilipatnam regions of Andhra Pradesh, 9-15 July.

Dr. K.K. Vijayan, Dr. K.V. Rajendran and Dr. S.S. Mishra, Scientists participated in the All India Workshop on Fish Dieseases: An appraisal of tools of research (light microscopy, immuno-electron microscopy and cytochemistry), organised by Dept. of Zoology, University of Madras and British Council, Madras Division, Madras, 21-26 August.

Dr. K.K. Vijayan, Scientist(S) served as a resource person in the training programme on shrimp diseases, conducted by Dr. D.V. Lightner and organised by MPEDA, Visakhapatnam, 28 - 30 August.

Dr. S. Ahamad Ali, Senior Scientist and Shri. D. Narayanaswamy, Scientist (SG) attended the Meeting on Aquaculture Feed Development, Dept. of Biotechnology, New Delhi, 12-13 October.

Dr. B.P. Gupta and Dr. A.R. Thirunavukkarasu, Senior Scientists attended the Workshop on Climate Change and its Implications for Food and Livelyhood Security, M.S. Swaminathan Resesarch Foundation, Madras, 4-6 December.

Dr. S. Ahamad Ali, Senior Scientist attended the National Symposium on Technological Advancements in Fisheries and its Impact on Rural Development, Dept. of Industrial Fisheries, Cochin University of Science and Technology, Kochi, 6-8 December.

Dr. M. Krishnan, Scientist(SS) gave a Seminar on Coastal Aquaculture, based on his training at SEAFDEC, Iloilo, the Philippines, Madras, 16 December.

Dr. R.D. Prasadam, Principal Scientist discussed with the Principal, Aquaculture Research and Training Centre of CIFE on Inter-institutional project proposed to be undertaken, Kakinada, 1-3 February 96.

Dr. K.O. Joesph and Shri. S.V. Alavandi, Scientists (SS) attended the Seminar-cum-Exposition on aquaculture, organised by Madras-Chengalpattu Aquafarmers Association, Madras, 17 March.

MEETINGS

The Tenth and Eleventh Meeting of the Institute Management Commitee (IMC) were held on 7 September '95 and 22 February 1996.

The Staff Research Council (SRC) has met twice to review the progress of research projects during 7-9 September '95 and 18 - 19 March '96 respectively.

The Institute has conducted the ARS/NET/SRF Examinations at Madras, 5-7 October.

The World Bank Review Committee meeting of NARP-Phase II Basic research subproject on Aquaculture was held at Madras during 14-15 December. The meeting was chaired by Dr. S.L. Mehta, Deputy Director General (Education).Dr. T.C. Jain, Agriculture Research Specialist from World Bank, New Delhi, Dr. Kunthala Jayaraman, Director, Centre of Biotechnology, Anna University, Madras, Dr. B.B. Jana, Professor & Head, Dept. of Zoology, Kalyani University, Dr. M.Y. Kamal, Asst. Director General (Fy), ICAR, Dr. K. N. Singh, Asst. Director General (NARP), Dr. K. Alagarswami, Director, CIBA and Principal Investigator, Shri. M. Ranadhir, Director, CIFA, and Co-Principal Investigator Dr. S. Ayyappan,

Principal Scientist, CIFA and scientists from CIBA have participated in the meeting.

The meeting of the Institute's Joint Council was held at Madras, 16 December 95 and 15 March 96.

The Second Meeting of the Research Advisory Committee of the Institute was held on 23-24 February 96 under the Chairmanship of Dr. T.V.R. Pillay, former FAO Aquaculture Consultant. Dr. P.V. Dehadrai, Deputy Director General (Fy), ICAR, Dr. R. Natarajan, Rtd. Director, Centre of Advanced Study in Marine Biology, Annamalai University and Dr. H.P.C. Shetty, Rtd. Director, Fisheries College, Mangalore, the RAC members attended the meeting and visited the Muttukadu Field Centre and had discussion with the scientists of the Institute.

TRAINING

Under the World Bank-assisted Project, one-month Training Course on Semi-intensive Shrimp Farming Technology was held on 5 occasions.

- 20 BFDA officials (10 from Orissa and 10 from West Bengal) during December 93-January 94.
- 13 BFDA officials from Andhra Pradesh during July-August 94
- 7 BFDA officials from Andhra Pradesh during May-June 95.
- 27 BFDA officials (9 from Andhra Pradesh and 18 from West Bengal) during August-September 95.

This training programme was sponsored by the Department of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India and executed by CIBA. The training programme included lectures, practicals and field visits.

Three officials from the Dept. of Fisheries, Govt. of Tamil Nadu were trained in shrimp desease diagnostics at Headquarters, 26 June - 1 July 95.

Shri. S.V. Alavandi, Scientist (SS) underwent a 40-days training course in microbial fermentation at University of Glasgow, United Kingdom from 9 August to 17 September 95.

Dr. M. Krishnan, Scientist (SS) completed a two-months training course in coastal aquaculture at SEAFDEC, Iloilo, the Philippines under the JICA fellowship for the Third World Countries, 27 September - 25 December 95.

Dr. S.M. Pillai, Senior Scientist attended a training programme in extension methodology at SEAFDEC, Bangkok, Thailand, 3 November - 8 December 95.

Seven fish farmers from Port Blair, Andaman and Nicobar Islands were trained at Headquarters (Madras) and field centre (Muttukadu), 11 January 96.

Thirtyone trainees from the Inland Fisheries Training Centre of CIFE, Barrackpore were given lectures on brackishwater aquaculture at Headquarters, 19 January 95.

Nine fish progressive farmers from Visakhapatnam, Andhra Pradesh were trained on various aspects of brackishwater aquaculture at Headquarters, 11 March 96.

STAFF NEWS

Appointment

Technical Assistant

Shri. Vasanthakumar Charles as T-II-3 at Madras, 20 November, 95

Shri. S. Rajukumar as T-II-3 at Madras, 28 November.

Shri. S. Rajeshwar Singh as T-II-3 at Madras, 1 December.

Shri. J. Joesph Sahaya Rajan as T-II-3 at Madras, 8 December.

Shri. Marella Ravi as T-II-3 at Madras, 11 December.

Shri. C. Ananthanarayanan as T-1 at Madras, 6 October.

Miss. Chhanda Mazumdar as T-1 at Kakdwip, 28 November.

Shri. K. Jagan Mohan Raj as T-1 at Madras, 15 February 96.

Shri. M. Chinnakuppan as T-1 at Madras, 26 February.

Administrative personnel

Shri. G. Sasidharan as Administrative Officer at Madras, 11th December, 95

Miss. K. Subhashini as Junior Stenographer at Madras, 23rd August.

Shri. R. Suresh as Junior Clerk at Madras, 1 June.

Shri. A. Sekar as Junior Clerk at Madras, 26 September.

Smt. E. Mary Desouza as Junior Clerk at Madras, 6 October.

Shri. P. Srikanth as Junior Clerk at Madras, 23 February 96.

Auxillary personnel

Shri. K. Jaganathan as Driver at Madras, 6 December, 95

Supporting personnel

Shri. M. Pitchandi as SS Grade I at Madras, 3 August, 95

Shri. R. Balakumaran as SS Grade I at Madras, 20 September.

Shri. R. Kumaresan as SS Grade I at Madras, 27 March, 96.

Promotions

Shri. A.B. Mondal, Senior Clerk as Assistant at Kakdwip, 6th June 95.

Shri. P.N. Rajasekaran Nair, Junior Clerk as Senior Clerk at Narakkal, 25 May.

Shri. P.K. Ray, Junior Clerk as Senior Clerk at Kakdwip, 19th June.

Smt. V. Usharani, Junior Clerk as Senior Clerk at Madras, 24th May.

Shri. P. Manickyam, SS Gr. III as Technical Assistant (T-1) at Madras, 10 November.

Shri. S.S.. Maity, SS Gr. III as Technical Assistant (T-1) at Kakdwip, 18 November.

Shri. P.S. Samanta, SS Gr. I as Technical Assistant (T-1) at Kakdwip, 21 November.

Shri. S.K. Haldar, Jr. Stenographer as Stenographer at Kakdwip, 7 March 96.

Relief

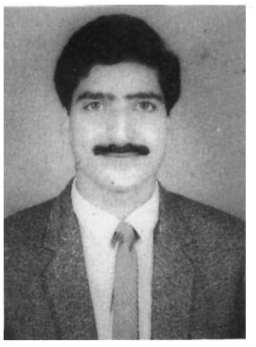
Shri. S. Gopalakrishnan, Technical Assistant (T-II-3) relieved on resignation, 15 September 95.

Shri. S. Veerasamy, Administrative Officer relieved on transfer to the Directorate of Rice Resarch, Hyderabad, 11th December.

Shri. K. Jaganathan, Driver relieved on resignation, 27th January 96.

AWARD

Dr. S. S. Mishra, Scientist at Headquarters was selected for Jawaharlal Nehru award for



1995 for his Doctoral Research work on "Molecular Characterisation of Fowl pox Virus: Analysis of protein and genomic profile of vaccine strain and field isolates", carried out at Indian Veterinary Research Institute, Izatnagar.

PUBLICATIONS

(Year of publication in parenthesis)

CIBA Bulletin

No. 1. An overview of brackishwater penaeid shrimp and finfish culture research in India in 1980 (1987).

No. 2. Prawn farming - Candidate species (1992).

No. 3. Shrimp diseases, their prevention and control (1995).

No. 4. Technology for *Artemia* cyst and biomass production (1995).

No. 5. Microparticulate feed for postlarvae of shrimp *Penaeus indicus* (1995).

No. 6. Development of broodstock and maturation of tiger prawn *Penaeus monodon* in captivity (1995).

No. 7. Biology, fishery, culture and seed production of pearlspot *Etroplus suratensis* (Bloch). Part I : Biology, fishery and culture. Part II : Methodology for seed production (1995).

No. 8. Backyard hatchery technology for the white shrimp *Penaeus indicus* (1995).

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