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DISEASES AND DISEASE CONTROL IN *MACROBRACHIUM* CULTURE

by

Carl J. Sindermann
Director, Middle Atlantic Coastal Fisheries Center
National Marine Fisheries Service
Highlands, New Jersey 07732

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ABSTRACT

Disease and mortality problems in *Macrobrachium* culture have thus far been relatively minor. Disease entities which have been identified include shell disease, filamentous bacterial infestation, egg fungus infestation, ciliate infestation, and muscle necrosis. Several other diseases of uncertain etiology have been mentioned in published reports, including a systemic fungus infection and a protozoan (suctorian) disease. Most of the diseases recognized seem to be consequences of poor water quality or other stresses, and chemical or other control measures have been developed for most of the disease conditions encountered.

INTRODUCTION

The short history of *Macrobrachium* culture has been remarkably free of the kinds of serious disease outbreaks with concomitant mass mortalities that have characterized (and still characterize) culture of a number of other aquatic species. Complacency can be dangerous, however, and it is prudent to assemble as much information as we can about diagnosis and control of those infrequent outbreaks which do occur, so that we may be better able to cope with major events, should they appear.

In the year and a half since the first prawn culture workshop, held in November, 1974, several publications have referred to disease problems in Macrobrachium. These papers usually describe the condition generally, then report attempts at control and the effectiveness of such attempts. I have tried in the present summary to provide a digest of what we know of Macrobrachium diseases and their control from the published literature, hoping that such a digest may serve as a base for discussion of new disease events and new information about control.

To provide some structure, I have selected several disease entities which have emerged in Macrobrachium culture. They are:

(1) shell disease (black spot)

(2) filamentous bacterial infestation (Leucothrix)

(3) egg fungus infestation (Aphanomyces and Achlya)

(4) ciliate infestation (Epistylis)

(5) muscle opacity and necrosis

Additionally, I have considered briefly several other poorly defined disease conditions under the heading "Diseases of uncertain etiology", hoping that more information about them will be forthcoming.

(1) SHELL DISEASE (Black Spot)

Shell disease, also referred to as black spot or brown spot disease, continues to be one of the most common and potentially serious problems in Macrobrachium culture. Evidence is accumulating that mechanical disruption of the epicuticle is necessary, to provide a portal of entry for chitin destroying bacteria and other secondary microbial invaders. Chitinoclastic bacteria isolated from shell lesions of M. rosenbergii in the U. K. were

predominately Benekea, but Pseudomonas and Aeromonas were also represented (Delves-Broughton and Poupard, 1976). These authors concluded that "Shell disease does not appear to lend itself to prophylactic or chemotherapeutic control. Methods to reduce the incidence of shell disease include more careful handling of the animals, controls to reduce aggression amongst individuals, and a reduction in stocking density."

Dugan and Frakes (1973) and Dugan et al. (1975) found black spot to be the most prevalent disease of adult Macrobrachium. The sequence of events in their study included mechanical damage to the exoskeleton, attack by chitinoclastic bacteria, and finally invasion by a lethal freshwater phycomycetous fungus. These authors found that the fungus (not further described) could be destroyed with a 15-30 minute dip in 20 o/oo seawater. They also noted that under good environmental conditions the disease never became a problem.

(2) FILAMENTOUS BACTERIAL INFESTATION (Leucothrix)

Sandifer and Smith (1975) described bacterial infections of gills, pleopods and uropods of juvenile M. rosenbergii in a very intensive rearing study in 1975. Leucothrix-like organisms predominated. High mortalities occurred; the disease affected most individuals, but the authors were not sure if the infection contributed directly to mortalities. Several chemical treatments were tried but were ineffective, inconsistent, or toxic. Prophylactic measures -- reducing population densities and more careful cleaning of tanks -- gave best results.

Filamentous bacterial infestations of Macrobrachium larvae, tentatively identified as Leucothrix, experienced by Aquaprawns Inc. in Texas, were controlled by mass water exchange when significant numbers were observed (Dugger, personal communication). Positive but inconsistent responses were seen when Nitrofurazone and Erythromycin were used.

(3) EGG FUNGUS INFESTATION

Fungi of two genera, Aphanomyces and Achlya were isolated from eggs of ovigerous females of M. rosenbergii by Dr. C. E. Bland in 1974 from material supplied by Dr. T. I. J. Smith (personal communications from each). Hyphae completely covered the ova, but as Dr. Bland pointed out, both genera of fungi are common in the aquatic environment, and there is some question as to whether they were actually parasitizing the eggs.

(4) CILIATE (Epistylis) INFESTATION

During the fall and winter of 1975, Aquaprawns Inc. experienced infestations of larvae by the ciliate Epistylis, sufficient to prevent feeding (Dugger, personal communication). Ten different chemical treatments were tested. Formalin caused mortalities, molting deformities and cessation of feeding. Only sulfa-quinine and acetic acid were effective consistently, and because of the high cost of sulfa-quinine, acetic acid was selected as the control method of choice at 2.0 ppt for 1 min. dip. Some Epistylis survived the dip, however, and could reinfest the population.

Epistylis has also been recognized as a problem in Hawaiian Macrobrachium culture (Nakamura, personal communication). Up to 10% of harvested prawns may be infested, reducing their marketability.

Fujimura (in Goodwin and Hanson, 1975) reported that water hardness, on the order of 300 ppm, resulted in growth of an Epistylis in Hawaiian ponds, with no solution except to move to other ponds with lower mineral content. (Excessively high calcium carbonate content of culture water may also lead to abnormal deposition on the exoskeleton of larvae -- a condition which may result in mortality).

(5) MUSCLE OPACITY AND NECROSIS

A progressive opacity of body muscles followed by necrosis has been reported in Macrobrachium post-larvae and juveniles by several workers (Sandifer et al., 1975; Delves-Broughton and Poupard, 1976). The disease condition seems associated with environmental stress. Sandifer et al. found that post larvae placed in high salinity (35 o/oo) turned opaque white and died in about a day. Delves-Broughton and Poupard referred to the disease condition as "white syndrome", and reported that salinity, temperature, oxygen, or other stress would cause Macrobrachium and other shrimps to turn white. The color change began in the tail and progressed anteriorly.

Other authors have associated the condition in penaeid shrimps with stress (Venkatoramaiah, 1971; Rigdon and Baxter, 1970), and found that it was reversible if necrosis had not progressed. Delves-Broughton and Poupard (op.cit.) noted that Macrobrachium with the syndrome had a soft exoskeleton, and exhibited slow growth and high mortality.

A condition with some similarity to the muscle opacity and necrosis described above was reported by Fujimura and Okamoto (1972). Exposure of Macrobrachium to direct sunlight in Hawaii resulted in formation of opaque white spots which gradually spread over the entire body until death occurred.

(6) DISEASES OF UNCERTAIN ETIOLOGY

Delves-Broughton and Poupard (1976) described and illustrated a condition in M. rosenbergii in which black nodules formed in the hypodermis, without any break in the exoskeleton. The authors suggested that the origin of the nodules could be bacterial. Furanace at a concentration of 0.09 mg/l seemed to arrest the disease.

Fujimura (1966) described a condition in M. rosenbergii larvae characterized by small opaque white patches beginning at the base of appendages and then spreading throughout the entire body, producing sporadic heavy larval mortalities. Ling (1969) considered this to be a systemic fungus infection but no description of the causative organism is available. There are other vague reports of fungus infections (Sick and Beaty, 1974) but adequate information has not been released.

Smith et al. (1974) reported quite a different fungus infestation of larvae, apparently associated with accumulation of decomposing food in the tanks. The fungus grew on the anterior appendages and tails of larvae, and produced some mortality. Control was effected by reducing larval density and removing the excess food.

Fujimura (1966) and Ling (1969) mentioned a "protozoan disease" possibly caused by a suctorian, which caused high mortalities of larvae. Control was effected with malachite green, formalin, and copper sulfate. [Fujimura's] dosages were 6 hrs with 0.4 ppm copper concentration; daily half-hour treatment with 0.2 ppm malachite green; and a daily half-hour treatment with 200 ppm formalin.

CONCLUSIONS

The remarkably short list of diseases known to be problems in Macrobrachium culture may be due in part simply to lack of adequate examination, but it seems true that those disease conditions which have surfaced thus far seem to be a consequence of poor water quality or other forms of stress, such as overcrowding. The disease organisms recognized so far seem to be facultative pathogens rather than obligate or primary pathogens -- facultative in the sense that they exert their effects when physiological or environmental conditions become marginal for the host animal or population.

It is becoming apparent that too often in examining aquaculture mortality problems we focus narrowly on a search for pathogens, when the real cause may be environmental, nutritional or physiological, with the superimposition of infection by facultative microorganisms on weakened or damaged hosts. This does not imply, however, that infectious diseases should be ignored -- simply that other causal factors should be considered, and water quality conditions monitored consistently.

It seems clear that there is a tendency for too much reliance on chemical crutches. Chemotherapy should be a method of last resort rather than a method of choice in aquaculture disease control. Of course it is still important to have treatments elaborated for those occasions when other preventive and prophylactic measures that are part of good animal husbandry fail.

The most important conclusion, however, is that disease has thus far not been a major limiting factor in Macrobrachium culture. Continued attention should be paid during this grace period to the development of control measures for those disease problems which have been recognized.

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